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APOLLO S/C

DEACTIVATION PROCEDURES

FOR LANDING SAFING TEAM

MISSION AS501
(SC 017)

Contract NAS9-150
Exhibit I; Paragraph 10.8

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SECTION I

GENERAL

1-1. The Apollo Deactivation Manual provides the NASA/NAA landing safing team (LST) with command module (CM) evaluation and reaction control system (RCS) deactivation procedures. In addition, various data relative to safety, fire fighting, and pyrotechnic safing are included.

NOTE

A 24-hour security watch shall be maintained during CM deactivation.

1-2. CM RCS

1-3. The CM RCS is utilized to control CM roll, yaw, and pitch attitudes following CM-SM (service module) separation; and during normal or abort entry maneuvers. RCS control is achieved either automatically or manually from within the command module. System redundancy or backup is provided by two separate independent systems, designated system A and system B. (See figure 1-1.)

1-4. RCS PROPELLANTS

1-5. Nitrogen tetroxide (N_2O_4) and monomethylhydrazine ($CH_3NH\ NH_2$) serve as RCS propellants. The propellants are stored in four separate titanium tanks, two oxidizer (N_2O_4) and two fuel ($CH_3NH\ NH_2$). Each tank contains a Teflon-pressure expulsion bladder activated by pressurized helium gas. Propellants within the bladders are expelled through distribution lines (associated valves, regulators, etc.) to the injector valves. Upon command, the injector valves open allowing fuel and oxidizer to impinge within the combustion chamber where hypergolic ignition occurs. Thrust resulting from hypergolic ignition is controlled by the length of time the injector valves are open.

WARNING

- N_2O_4 and $CH_3NH\ NH_2$ are highly toxic. Work areas shall be periodically monitored for accumulation of propellant vapors.

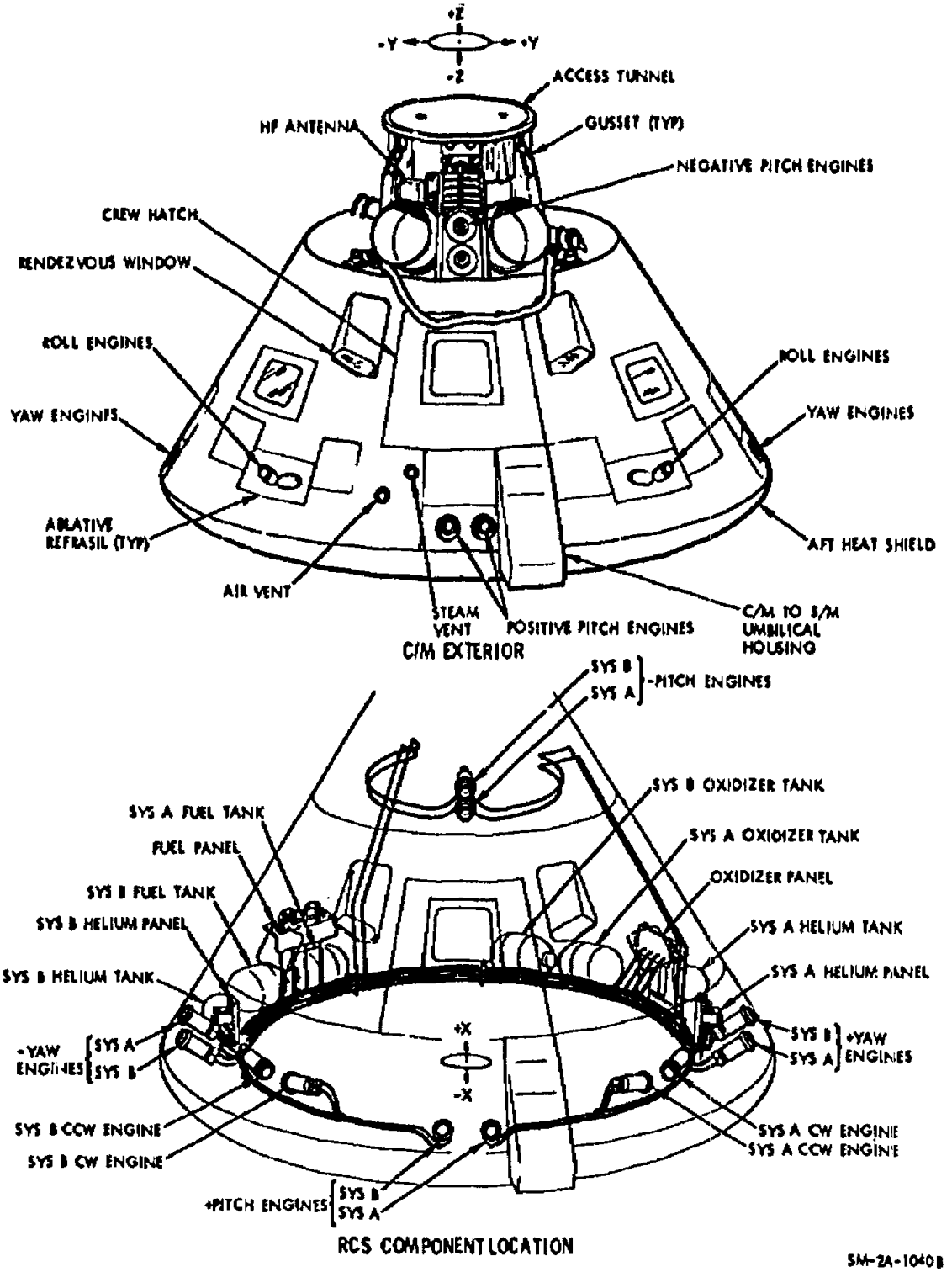


Figure 1-1. CM Exterior and RCS Component Location

- Personnel responsible for CM evaluation and RCS deactivation shall be thoroughly familiar with the emergency procedures and safety precautions provided within paragraphs 1-26 through 1-34, prior to initiating any evaluation, safing, and deactivation procedures within this manual.

1-6. NITROGEN TETROXIDE (OXIDIZER)

1-7. Nitrogen tetroxide (N_2O_4) is an equilibrium mixture of nitrogen tetroxide and nitrogen dioxide. Fumes vary in color from light orange to reddish brown, depending on temperature, and carry a pungent to musty odor. Liquid N_2O_4 is also affected by temperature; color varies from a reddish brown to a blue or green when cold.

WARNING

- Body contact with liquid N_2O_4 will cause burns similar to those induced by nitric acid. Brief contact with liquid N_2O_4 results in yellow staining; if contact is more than momentary, a severe chemical burn occurs.

- Blindness may be caused by liquids entering the eyes; if swallowed, internal burns may be sudden and severe, resulting in death.

- Prolonged inhalation will result in irritation of the respiratory tract and possibly cause pulmonary edema (lungs fill with liquid).

NOTE

Refer to paragraph 1-36 for applicable first aid and instructions.

1-8. MONOMETHYLHYDRAZINE

1-9. Monomethylhydrazine ($CH_3NH\ NH_2$) is a clear, colorless liquid having an odor similar to that of ammonia. It can be stored safely, without deterioration, for extended periods of time and over a wide temperature range. The exposure of monomethylhydrazine to air on a large surface may also result in spontaneous ignition.

WARNING

- Body contact with liquid $CH_3NH\ NH_2$ can cause local damage resembling burns; in addition, it can penetrate skin to cause systemic effects.

- Inhalation of vapors cause from slight to severe irritation of the respiratory passages, as well as systemic effects.

NOTE

Refer to paragraph 1-36 for applicable first aid instructions.

1-10. CM EVALUATION/DEACTIVATION

1-11. Following recovery, and upon receipt (or as soon as possible thereafter) of the CM at an interim port, LST members shall perform an evaluation of the CM RCS and pyrotechnic devices to determine their safety status. Evaluation and deactivation operations are conducted to assure the CM is safe for air shipment to a receiving facility within the United States, and shall be performed in the following sequence:

a. Preparation for deactivation (section II):

1. Position and service deactivation units, S14-137 and S14-138.

2. Ready deactivation units and make necessary plumbing and electrical connections.

b. Evaluation (section III):

NOTE

Establish electrical ground to CM using wire of 0-gauge or greater. One vehicle ground point is behind panel 22. Any point on inner structure of forward compartment may be used as a ground point.

1. Position CM and ascertain status of pyrotechnic devices and RCS.

2. Make necessary interface connections.

c. Deactivation (section IV and subsequent):

1. Perform applicable deactivation procedures.

1-12. If pyrotechnic devices or the RCS are determined unsafe, the NASA LST Director shall be responsible for improvising "on the spot" repairs.

NOTE

Refer to section III for information relative to pyrotechnic safing.

WARNING

- Portable propellant vapor detectors shall be utilized to periodically monitor working areas.
- CM air shipment shall not be initiated until all pyrotechnic devices have been safed (or determined safe) and the RCS deactivated.

1-13. REQUIREMENTS

1-14. PERSONNEL

WARNING

All personnel associated with CM evaluation and RCS deactivation shall be thoroughly familiar with the safety precautions and procedures contained within this manual.

1-15. Deactivation and safing operations are performed under the direction of the National Aeronautics and Space Administration (NASA), Manned Spacecraft Center (MSC), Landing and Recovery Division (LRD). The designated NAA (North American Aviation, Inc.) LST will function in support of the NASA MSC/LRD LST Director. The NAA LST will be comprised of five men: RCS engineer, electrical engineer, pyro technician, mechanical technician, and electrical technician. The RCS engineer shall function as the NAA Team Leader. In addition, medical and fire fighting personnel shall be notified of impending deactivation operations. Physical location of medical and fire fighting personnel shall be at the discretion of the NASA LST Director.

1-16. TOOLS AND EQUIPMENT

1-17. The following special equipment is required to perform CM evaluation and deactivation:

- Mobile crane (20,000-lb capacity)
- Flatbed truck to transport CM and dolly
- Aircraft tug or jeep to move deactivation units
- Fire truck with self-contained water supply
- Steady running water (1/2 to 3/4-inch-dia garden hose)
- M-S-A Billion-Aire portable fuel vapor detector (model 706P)
- M-S-A Billion-Aire portable oxidizer vapor detector (model 706P)
- S14-137 RCS fuel deactivation unit (P/N G16-848760)
- S14-138 RCS oxidizer deactivation unit (P/N G16-848770)
- A14-179 RCS nozzle adapter (P/N G16-824499)
- Simpson (model 260) VOM
- Alinco model 101-5BF meter (P/N 492-058)
- Regulator (air supply to air drill)
- Bubble manometer (250 cc Burette) 2 ea
- Test Pan STE 1519 1 ea

1-18. The following special tools, hardware, and supplies are required to perform CM evaluation and deactivation:

Nomenclature	Quantity
Apollo CM deactivation workstands (provided by NASA)	2
Coupling (ME273-0010-0002)	1
Face shield (model 7-11)	6
Coveralls, 2 pr per man (sized per individual)	11
Plastic bags, 4 x 4 in., 4 x 6 in., 10 x 12 in., 8 b 16 in.	100 each
Tape (green) 2-inch width	4 rolls
Tape No. 872	6 rolls
Part removal tags (Form 961-D)	100
Tygon tubing - 1/4 in. R3603, 1/2 in. B44-3, 3/4 in. B44-3, 1 in. B44-3	50 feet each

Nomenclature	Quantity
Clamps - AN737-24	18
AN737-26	6
AN737-46	6
Stainless steel tubing -	
Size - 1/4, 3/8, 1/2, and 1 (in 8-inch lengths)	2 each
1/4, 3/8, 1/2, and 1 (in 3-inch lengths)	2 each
B-nuts and sleeves -	
AN818-4C, -6C, -8C, and -16C	6 each
MS20919-4C, -6C, -8C, and -16C	6 each
Wire #16, #18, and #20 - 100-ft lengths	1 each
Spare pins - #16	40 each
- #20	20 each
Terminal lugs - #16, #18, and #20 to fit 10/32 screws	20 each
Plugs - 1/4 in. MS24401-4C	12
3/8 in. MS24404-6C	12
1/2 in. MS24404-8C	12
3/4 in. MS24404-12C	6
Caps - 1/4 in. AN929-4C	6
3/8 in. AN929-6C	6
1/2 in. AN929-8C	6
3/4 in. AN929-12C	6
Unions - 1/4 in. MS24392-4C	6
3/8 in. MS24392-6C	6
1/2 in. MS24392-8C	6
3/4 in. MS24392-12C	6
Flex lines (R3800CC-6-0600)	2
S/C window covers (P/N MK394-10061)	1 set
Legstat (grounding device for personnel)	2 each
Class C explosive container	2
M-S-A Billion-Aire supplies	1 box
NOTE Refer to paragraph 1-22 for a complete listing of consumable materials related to the Billion-Aire vapor detectors.	
Hoke bottles, 8 LDI-G and carrying cases	8
Gloves, rubber #124	8 pr
Boots, rubber MB866 (Oilace)	6 pr
Sweg-lock assy HUB-SST-4	6 ea
-6	6 ea
-8	6 ea
-16	6 ea
Miscellaneous equipment	1 box

1-19. TOOLS AND ACCESSORY EQUIPMENT. Except as noted, tools and equipment included with each deactivation unit are as follows:

Nomenclature	Part No.	Quantity
*Cable assembly	G16-848797-11	1
*Cable assembly	G16-880569-41	1
*Cable assembly	G16-848798-11	1
*Cable assembly	G16-848798-21	1
*Cable assembly	G16-848789	1
*Hose assembly	G16-848613	2
*Hose assembly	G16-848811-5	1
*Hose assembly	G16-848824-5	1
*Hose assembly	G16-848825-5	1
*Hose assembly	G16-848826-5	1
*Hose assembly	G16-848821-5	1
*Hose assembly	G16-848821-9	2
*Hose assembly	95579	1
*Hose assembly	95581	2
Hose assembly	95625	1
*Hose assembly	M66600012-0240	2
Loose equipment	G16-848742	1
†Cable assembly	G16-848798-11	1
†Cable assembly	G16-848798-21	1
†Harness assembly	G16-880569-51	1
†Harness assembly	G16-848786	1
†Harness assembly	G16-848797-21	1
†Hose assembly	G16-848811-3	1
†Hose assembly	G16-848821-3	1
Hose assembly	G16-848821-7	2
†Hose assembly	G16-848824-3	1
†Hose assembly	G16-848825-3	1
†Hose assembly	G16-848826-3	1
†Hose assembly	95578	1
†Hose assembly	95580	2
†Hose assembly	93625	1
Protective suit	P3421	3
Safety boots	BRC-300	3
Gas mask	OS-86847	2
Canister	GMN-SS-86652	2
Butyl gloves	B-174-R	3
Wrecking bar	B-9	1
Wire brush	B-81	2
†Screw hook	H-41	3
Adjustable wrench	W-155	2
Open end wrench	W-300	1
Open end wrench	W-302	1

*S14-138
†S14-137

Nomenclature	Part No.	Quantity
Cap assembly	AN929-12S	2
Long nose pliers	P-108	1
Box wrench	W-992A	1
Needle pliers	P-209	1
†Dikes	P-210	3
*Dikes	P-210	1
Socket set	S-14D	1
Safing caps	S01-10390-11 (alt S01-470)	18
Pneumatic drill	500D-2	1
Spur drill	177	2
Pneumatic hose	S8-25-1-1	1
Socket extension	W-953	2
Socket	W-923	1
Screwdriver	268P-10	3
Auger brace	5010-A	3
Auger bit	22	6
Socket breakover	AT22	1
Deep socket	AL26T	2
Deep socket	AL36	2
Socket set	V51B	1
Drill, #32	W-18	12
Drill, 1/2-inch	Type 72	6
Plug tool	TSK1641	1
Plug tool	TSK1642-1	1
Plug tool	TSK1642-2	1
Adjustable wrench	AC124	3
Pump	Model 3790SS	2
Hose	ATCO 1178-12	2
Bolt	NAS501-8-50	2
Clip	TC1-1 60 Series	12
Valve	Y328A	4
Reducer	1/2 x 1/4 PTR-SS	4
Pipe connector	1/4GG-SS	4
Adapter	AN816-6S	4
Spanner wrench	G16-848828	3
Crimping tool	G16-848823	4
Sample container	6023 or 1600	3
Cap	AN929-6S	4

*S14-138
†S14-137

1-20. ELECTRICAL TECHNICIAN TOOL BOX CONTENTS. The tool box for the electrical technician shall contain the following items:

Nomenclature	Mfr/Type/Part No.	Quantity
Flashlight battery, size D	#950	12
Flashlight	RAY-O-VAC Sportsman	3
Universal test leads	Smith Co. #699	5 kits
Screwdriver torque set— #2, #3, #4, #6, 1/4 in.	Apex	1 each
Torque tip - #2, #4, #6, #8, and #10	Apex	1 each
Ratchet offset screwdriver	Snap-on, CRA-180K	1
Standard tip screwdriver set - #1410, #234, #204, #146, #145, #143, #12, #8, #6, #4, #2, and #1	Snap-on, SS5 and SDD-130	1 each
Phillips tip screwdriver set - #64, #53, #42, #31, #22, and #21	Snap-on, SSDP-60	1 each
Jewelers screwdriver set	Hunter, X-K24B	1 set
Nut driver set	Xcelite, PS-120	1 set
Soldering iron handles	Ungar, 776	2
Heating units	Ungar, 1235	2
Tips	Ungar, PL333	2
Anti-wicking tool	Crem, 881, AWG-22	1
Little tie heat shunts	No. HS-1	2
Acid brush	No. 1	1
Brass brush	No. 210	1
Klean tip kit	Leroy, No. 50	1
Midget socket set, 1/4-in. drive	137-TM-B	1
Midget combination wrench set	Snap-on, OX1-705	1
Ignition wrench, 1/8 in.	Snap-on, DS-88	1
Ignition wrench, 5/32 in.	Snap-on, DS-1010	1
Ignition wrench, 3/16 in.	Snap-on, DS-1212	1
Ignition wrench, 15/64 in.	Snap-on, DS-1516	1
Pliers - short needle nose	Snap-on, 60-C	1
Pliers - duck bill	Snap-on, 60-R	1
Pliers, diagonal	Snap-on, 387C	1
Wire twister	Robinson, M84 9 in.	1
Scale, 6 in.	General, 616	1
Mirror	Snap-on, GA-52A	1
Mirror	Snap-on, GA-53A	1
Soldering aid	SH-20C	1
Long nose pliers	Snap-on, E701	2
Short nose pliers	Snap-on, E708	1

Nomenclature	Mfr/Type/Part No.	Quantity
Dykes	Snap-on, E706B	1
Hex driver set	Hunter, K5M1	1
Scissors	Gold Seal, 104	1
Allen wrench, #9	Hunter, 45116	1
Spot-tie cord		1 roll
Electrical tape, 1/2 in.		1 roll min
Electrical tape, 1 in.		1 roll min
Ignition wrench set	Snap-on, DS-1526	1 set
Magnet, 18-in. flex handle		1
Wire strippers		1
Terminal crimping tool		1
Stopwatch		1
Pliers, Cannon plug		1
Bulbs - flashlight		6
Ball-peen hammers, 12oz., 16oz.		1 ea
Scribes (6-inch)		3 ea
Resin-core solder		2 rolls

1-21. MECHANICAL TECHNICIAN TOOL BOX CONTENTS. The tool box for the mechanical technician shall contain the following:

Nomenclature	Mfr/Type/Part No.	Quantity
Socket set, 3/8-in. drive	Snap-on, 219-F	1
Midget socket set, 1/4-in. drive	Snap-on, 137-TMB	1
Torque set screwdriver - #2, #3, #4, #6, #10, 1/4 in.	Apex	1 each
Standard tip screwdriver set - #12, #8, #6, #4, #2, #1, #146, #145, #143, #1410, #234, #204, #SS5	Snap-on, SSD5-130	1 each
Phillips screwdriver set - #64, #53, #42, #31, #23, #21	Snap-on, SSDP-60	1 each
Deep socket set, 3/8-in. drive	Snap-on, 211-SF	1
Socket set, 1/2-in. drive	Snap-on, 319-M	1
Handle adapter	Snap-on, A-2	1
Midget combination wrench set	Snap-on, OX1-705K	1
Pliers, short needle nose	Snap-on, 60C	1
Pliers, duck bill	Snap-on, 60R	1
Flashlight batteries, size D	#950	12
Flashlight	RAY-O-VAC Sportsman	3
Mirror	Snap-on, GA-52A	1
Punch set	Snap-on, PPCD-60K	1
Ball peen hammer	Snap-on, BP-8	1
Steel tape	Lufkin, W7210	1
Scale, 6 in.	General, 616	1

Nomenclature	Mfr/Type/Part No.	Quantity
Combination wrench set	Snap-on, CEX-714-K	1
Diagonal pliers	Snap-on, 387C	1
Nut driver set	Xcelite, PS-120	1
Torque tip - #2, #4, #6, #8, and #10	Apex	1
Rachet offset screwdriver	Snap-on, CRA-180K	1
Diagonal pliers	Snap-on, 85	1
Short nose pliers	Snap-on, E708	1
Dykes	Snap-on, E706B	1
Adjustable wrench, 18-in.	Williams	1
Metal master snips (right cut)	Wiss, M2R	1
Metal master snips (left cut)	Wiss, M1R	1
Strap wrench	Ridgid, 5	1
Chisel	DASCO, 417	1
Crows feet, 3/8 to 2 in.		1 each
Magnet, 18-in. flex handle		1
Knife, linoleum		2
Vice grips, 8 in.		2
Pliers, common		2
Ball peen hammer, 12 oz, 16 oz		1 each
Bonney wrenches, 3/4 through 1-1/2 in., 1/4 through 11/16 in.		1 each
Strap wrench (chain type)	Williams, CW-4	1
Stopwatch		1
Wrench, pipe - 14 in.		1
Files - assorted		1 each
Bulbs - flashlight		6
Chipless cutters - 1/4 in., 3/8 in., 1/2 in., 5/8 in., and 3/4 in.		1 each
Bolt cutter		1
Extractors, No. 1 through No. 5	EZY-OUT	1 set
Taps -		
9/16 - 18 UNF-2A		2
1/2 - 20 UNF-2A		2
7/16 - 20 UNF-2A		2
Tubing cutter (chipless) - handtool #312-FB		1
Flaring tool (tubing) - handtool #400-F		1
Hacksaw #368 (6 blades each)		1

1-22. CONSUMABLE MATERIALS. Consumable materials required for deactivation are as follows:

Nomenclature	Specification	Quantity
Isopropyl alcohol, grade A	Fed Spec TTI-735 (grade A)	4 drums (220 gal.)
Cleaning agent, 1, 1, 2 trichloro -1, 2, 2, trifluoroethane (Freon TF)	Fed Spec MB0210-005	4 drums (220 gal.)
Neutralizer	Del Chem 2302C	1 drum (55 gal.)
Neutralizer	Del Chem 2303C	1 drum (55 gal.)
Distilled water	Commercial	80 gal. (min)
K-bottles (N_2)	MIL-P-27401	20
*Trifluoroacetic acid, 500 gram	88195	1 bottle
*Diethylamine, 2000 gram	88197	1 bottle
*Scrubber refill kit (10 refills, filter discs, and spare screens)		2
"Soda lime" for acidic reagent	P/N 92684	
"Ion exchange resin" for basic reagent	P/N 92685	

*Utilized in conjunction with Billion-Aire portable propellant vapor detectors.

1-23. PHOTOGRAPHIC COVERAGE

1-24. Photographic coverage of CM evaluation and deactivation operations shall be as directed by the NASA MSC/LRD LST Director. Motion pictures as well as still photographs are desired. Color film is preferred over black and white. Black and white film should only be used when natural light conditions do not permit color photography.

NOTE

- Still photographs; 35 mm acceptable, 2-1/4 x 2-1/4 or larger preferred.
- Motion pictures; 16 mm. Preferred frame rate 24 fps, may be varied to suit operational conditions.

1-25. The following photographs (motion and still) are considered the minimum to be taken during evaluation and deactivation operations:

WARNING

Check CM for propellant vapors using portable vapor detector, prior to taking any closeup photographs.

- Overall and closeups of any damage incurred during off-loading, evaluation, or deactivation operations.
- Closeups of entire RCS exterior surface area. (See figure 1-2.)
- Closeups of each RCS thrust chamber prior to deactivation. (See figure 1-2.)
- Closeups of RCS access areas following removal of access panels. (See figures 1-2 and 1-3.)
- Overall pictures depicting deactivation setup. (CM, GSE, and interconnecting plumbing.)

1-26. SAFETY

1-27. Personnel engaged in CM evaluation and deactivation operations may be exposed to the following hazards:

- Unexpended pyrotechnic devices
- Toxic fumes from hypergolic propellants
- Raw propellants
- Flash fires
- High pressures
- Radioactive debris.

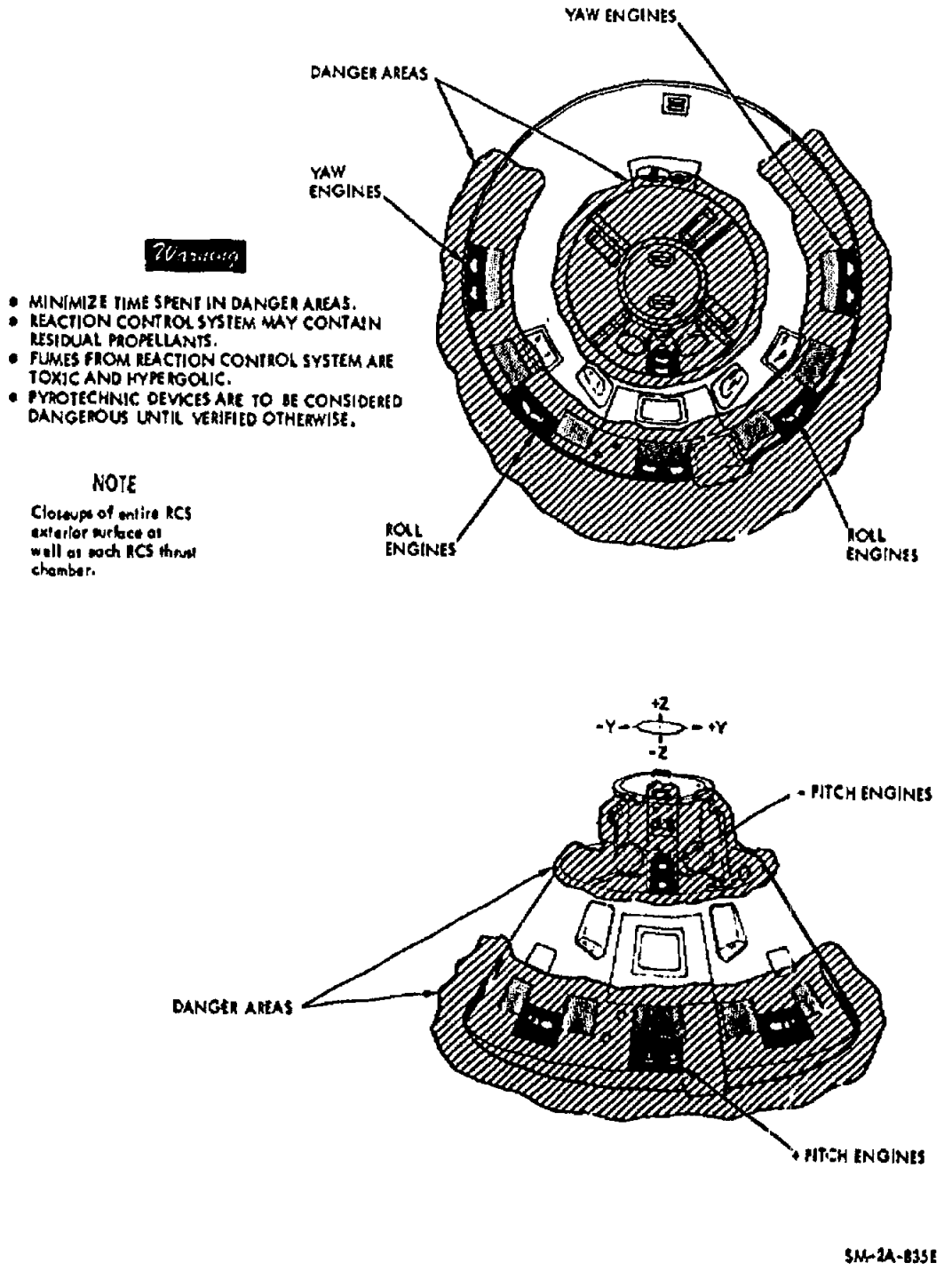
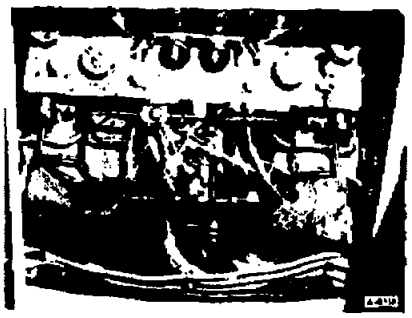
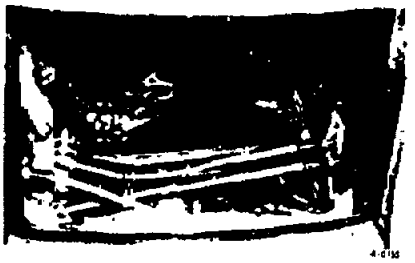


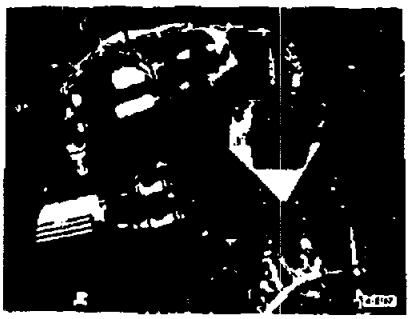
Figure 1-2. CM RCS Photographic Coverage



1 FUEL PANEL ACCESS

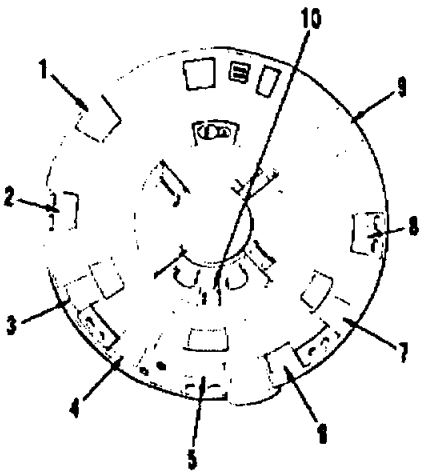


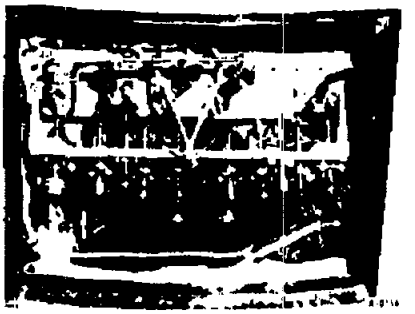
5 + PITCH ENGINE ACCESS



7 CW ROLL ENGINE ACCESS

2 He PANEL (SYS "B") AND -YAW ENG ACCESS





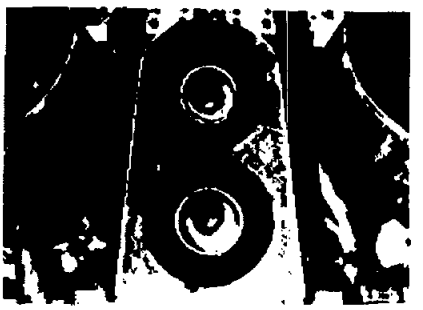
8 He PANEL (SYS "A") AND + YAW ENG ACCESS

3 CCW ROLL ENGINE ACCESS

9 OXIDIZER PANEL ACCESS

4 CW ROLL ENGINE ACCESS

6 SYS "A" CONTROL BOX (C19A1) AND CCW ROLL ENGINE ACCESS



10 - PITCH ENGINES

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Figure 1-3. CM RCS Access Areas, Panels Removed

Accordingly, all personnel concerned with CM evaluation and deactivation must be thoroughly familiar with the procedures within this manual. The NASA MSC/LRD LST Director shall assure that all supporting personnel (photographers, fireman, medical, etc.) and team members understand their individual tasks. Paragraphs 1-28 through 1-36 describe related emergency and first aid procedures.

1-28. SAFETY MEASURES. Personnel performing CM evaluation and deactivation operations are subject to propellant contamination (liquid or vapor). (See figure 1-4.) Accordingly, protective clothing and equipment are provided to minimize this danger. (Refer to paragraphs 1-18 and 1-19.) LST members should make frequent inspections of their personal clothing/equipment to detect any flaws that might result in personal injury. In addition, items of clothing and equipment must be properly adjusted to prevent body contamination.

NOTE

- When ambient temperatures are high, protective clothing becomes quite uncomfortable. To alleviate this problem, it is suggested that the wearer shower himself periodically. The shower will serve as a cooling agent as well as provide a method of checking personal garments for leaks.

- Protective clothing shall be worn by at least two members of the LST during all evaluation and deactivation operations.

1-29. PROPELLANT VAPOR EXPOSURE LIMITS. Maximum Acceptable Concentration (MAC) and Threshold Limit Values (TLV) are terms utilized to define propellant vapor exposure limits. The National Academy of Science defines the MAC for MMH and NO_2 as 0.1 ppm and 5 ppm, respectively. Likewise, the American Conference of Government Industrial Hygienists defines the TLV for MMH and NO_2 as 0.2 ppm and 5 ppm, respectively. Maximum Acceptable Concentration and Threshold Limit Values represent peak values that should not be exceeded; except in circumstances where impairment of health is justifiable in order to prevent a more serious event. Accordingly, should the LST detect vapor concentrations above the MAC or TLV they shall evacuate the area. Should this situation occur, only persons clothed in full protective suits will be authorized to enter the contaminated area.

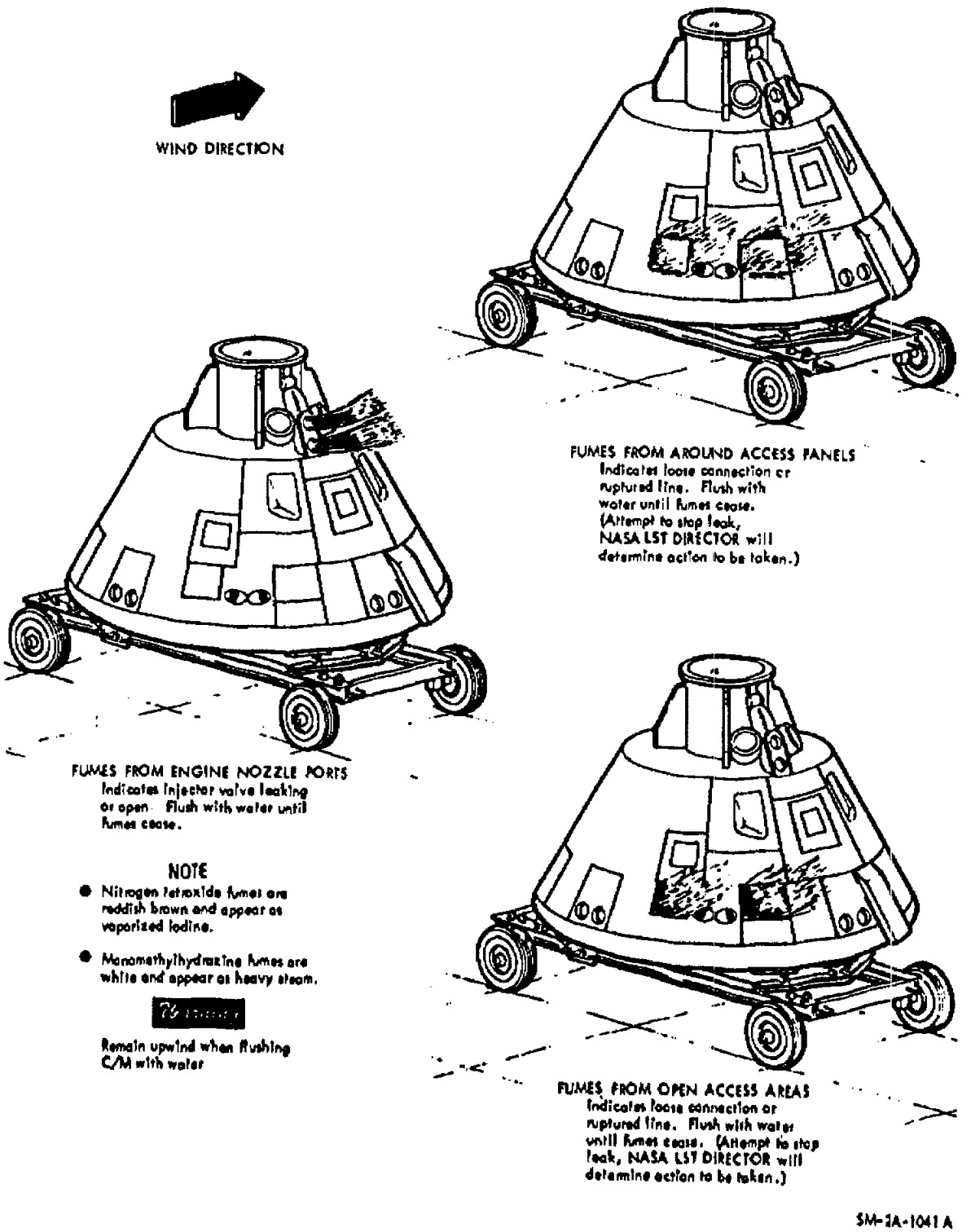
WIND DIRECTION
FUMES FROM AROUND ACCESS PANELS
Indicates loose connection or ruptured line. Flush with water until fumes cease. (Attempt to stop leak, NASA LST DIRECTOR will determine action to be taken.)
FUMES FROM ENGINE NOZZLE PORTS
Indicates injector valve leaking or open. Flush with water until fumes cease.
NOTE
Nitrogen tetroxide fumes are reddish brown and appear as vaporized iodine.
Monomethylhydrazine fumes are white and appear as heavy steam.
Remain upwind when flushing C/M with water
FUMES FROM OPEN ACCESS AREAS
Indicates loose connection or ruptured line. Flush with water until fumes cease. (Attempt to stop leak, NASA LST DIRECTOR will determine action to be taken.)
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Figure 1-4. Appearance of RCS Propellant Leaks

1-30. EMERGENCY PROCEDURES

1-31. The following information describes the action to be taken in the event of propellant spillages or fires. (See figure 1-5.)

1-32. PROPELLANT SPILLAGE. As a general rule, propellant leakage or spillage shall be treated as a fire. If fumes (brown or whitish) are observed coming from the CM RCS, immediately flush with large amounts of water (fresh or salt); continue until vapors cease.

NOTE

Fog-type nozzles should be utilized to disperse fume concentrations.

1-33. Small quantities of nitrogen tetroxide (brownish liquid) may be dispersed with dry chemicals (baking soda) followed by flushing with large amounts of water, thereby minimizing the fume (toxic vapor) hazard normally associated with nitrogen tetroxide spills.

CAUTION

Any surface that has been in contact with liquid propellants or fumes must be thoroughly flushed with water.

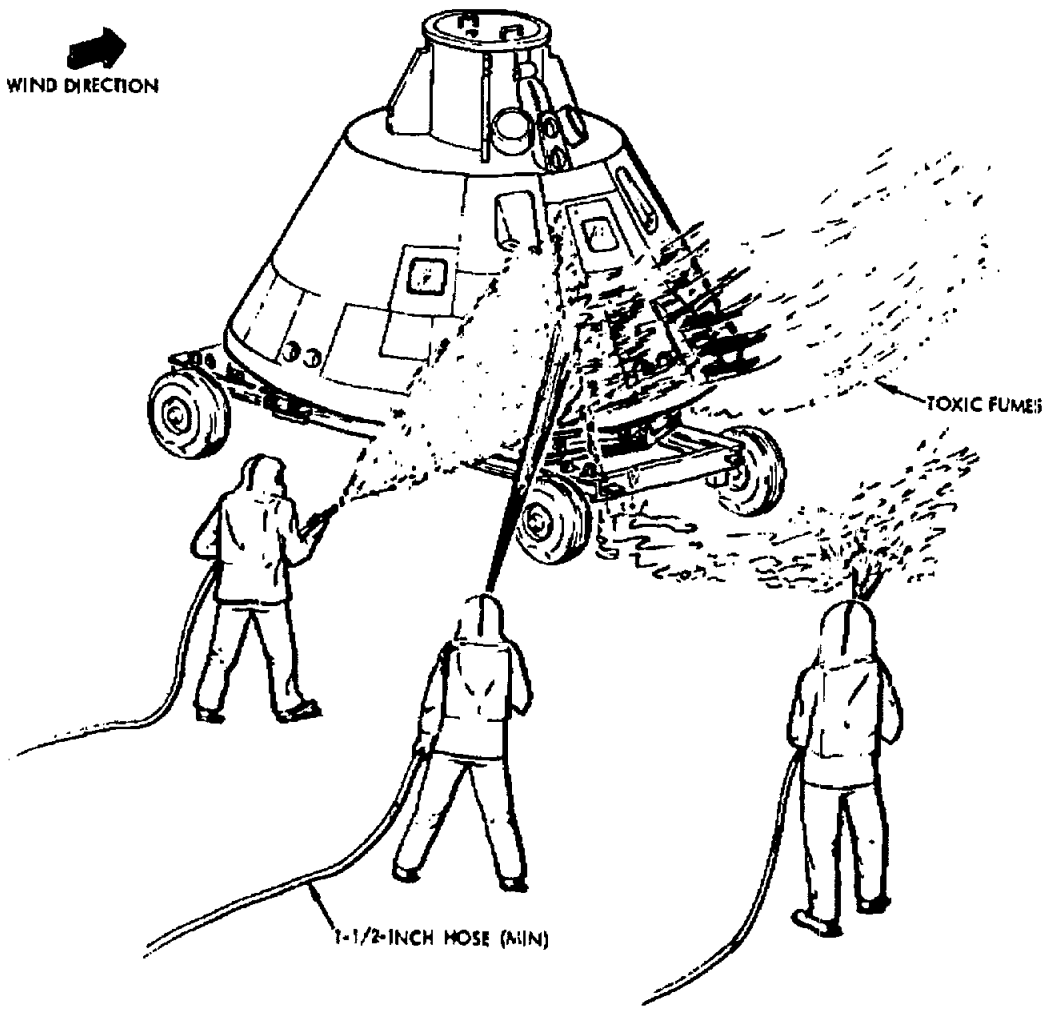
WARNING

Personnel working in contaminated areas shall use self-contained breathing units and stay upwind of the vapor source.

1-34. PROPELLANT FIRES. The combining of nitrogen tetroxide and monomethylhydrazine will normally cause "flare-type burning." Flare intensity will depend upon the rate of mixing and may display explosive violence if large quantities are mixed rapidly. Fires resulting from small amounts of propellants will quickly burn themselves out. In any case, should a fire occur, immediately douse the affected area with large amounts of water to control the fire and vapors.

NOTE

Vapors may be held "down" or dispersed by the application of fog. Liquids can be dispersed with streams of water.



1. Direct large amounts of low pressure water at base of flame.
2. Wash propellants away as soon as possible.
3. Wash down all equipment exposed to propellants.
4. Monitor RCS for fumes after fire has been extinguished.

NOTE

- Use high-capacity fog nozzle (low pressure) to disperse and absorb vapors.
- Fresh or salt water may be used to combat hypergolic fires.
- Remain upwind when flushing C/M with water.

Warning

- Do not stand in RCS thruster chamber area (approximately 20 feet from nozzle).
- Fumes are toxic. Fire fighting crew shall have on self-contained air supply equipment.

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Figure 1-5. Hypergolic Fire Fighting

1-35. Once the fire is under control, attempt to cut off the flow of fluid. Propellant lines may be crimped (crimping tool, G16-848823) for this purpose. Information relative to individual propellant fires is as follows:

WARNING

No such action will be taken unless so directed by the NASA LST Director.

a. Nitrogen Tetroxide (Oxidizer) Fires. The type of fire occurring in the presence of nitrogen tetroxide is governed by the combustible material or fuel involved. Spills may ignite materials, such as wood or rope (line), and the fire will be typical for the material burning. Thus, it can be said, nitrogen tetroxide will not burn by itself or with air, but will support combustion of combustible materials. Accordingly, if such fires are to be prevented, all combustible materials should be removed from the vicinity of the CM. If spills occur, and no fire exists, spray the area with dry chemical followed by a washdown with large amounts of water. The application of dry chemical will tend to prevent vapors as well as neutralize nitric and nitrous acids formed by the propellant coming in contact with damp surfaces.

b. Monomethylhydrazine (Fuel) Fires. Monomethylhydrazine fires may be of two types: fires supported in air and fires supported by an oxidizer (previously covered in paragraph 1-34). Fuel fires are most readily extinguished by the application of large quantities of water.

NOTE

Because of the wide flammable limits and reignition hazards, powders, water fog, and foams are not as effective as water dilution. However, fog should be utilized in conjunction with spray applications to assist in the dispersal of toxic vapors.

1-36. FIRST AID

1-37. Any person directly exposed to RCS propellants (either liquid or vapor) requires immediate first aid. Speed is of prime importance if injury is to be averted or minimized. If the eyes have been affected, the eyelids must be held open and the eyes flushed with a gentle flow of water (15 minutes minimum).

WARNING

- Flushing of the eyes shall take precedence over the summoning of medical aid.
- Neutralizing solutions should not be used except at the direction of a physician.

1-38. Persons having body contact with liquid propellants shall be sprayed with water and remain under the spray for a period not less than 15 minutes. Contaminated clothing shall be removed while the person is in the water spray.

1-39. If the respiratory system has been exposed and the individual is coughing, vomiting, or has lost consciousness, he shall be removed at once to a safe area for first aid treatment.

WARNING

- Personnel in this state should be carried and not allowed to walk.
- If breathing has stopped, apply artificial respiration, preferably with oxygen inhalation.

1-40. Should the person also be contaminated with liquid propellants, remove contaminated clothing and wash or bathe affected areas while oxygen is being administered.

1-41. Should propellants be inadvertently swallowed, drink large amounts of water (or milk) and obtain immediate medical attention.

1-42. Exposure to propellants (fuel and oxidizer) can produce irritant effects in the eyes, skin, and respiratory tract. Personnel responsible for CM evaluation and RCS deactivation should be familiar with the following symptoms associated with propellant exposure.

WARNING

Should any of these symptoms appear following exposure, seek immediate medical attention.

a. Inhalation of monomethylhydrazine vapor causes slight to severe irritation of the respiratory passages, as well as systemic effects. Systemically, monomethylhydrazine is a potent central nervous system stimulant; therefore, tremors and convulsions may occur. Poisoning can also result in hemolytic anemia during the first week or two after exposure. Nausea and vomiting are normally the first signs of significant systemic absorption.

b. The immediate effect of nitrogen tetroxide vapor inhalation is respiratory irritation and irritation of the eyes resulting in coughing and tearing. Higher concentrations make breathing almost impossible, coughing will be paroxysmal. (Exposure of this magnitude requires immediate medical attention.) Delayed effects, resulting from N_2O_4 inhalation will normally appear approximately 24 hours (or later) after exposure; irritation of the eyes and throat, coughing, tightness of the chest, and nausea, may be slight and go unnoticed. Then, hours later, severe symptoms begin; their onset may be sudden and precipitated by exertion. Coughing, a feeling of constriction in the chest and difficult breathing are typical. Cyanosis of the eyelids, mouth, lips, and fingernails may follow. Milder cases may show signs of bronchitis with cyanosis.

SECTION II

PREPARATION FOR DEACTIVATION

2-1. GENERAL

2-2. Information and procedures within this section are designed to assist the landing safety team prepare for safing and deactivation operations. Positioning and equipment preparation, while seemingly a meager task, is quite meaningful if deactivation is to be accomplished in a timely manner. Accordingly, it is suggested that the information within this section be reviewed and utilized as a guide when preparing for deactivation operations.

2-3. POSITIONING DEACTIVATION UNITS

2-4. Information relative to site selection and equipment positioning is given in the subsequent paragraphs.

2-5. SITE SELECTION

2-6. Prior to positioning deactivation units, associated equipment, etc., it will be necessary to select a site suitable for conducting deactivation operations. Prerequisites relative to site selection are:

a. Area must be well ventilated and/or capable of supporting ventilation equipment, i.e., large fans, etc.

b. Have access to a ready water supply (fire hydrant as well as tap).

c. Contain adequate drainage provisions to accommodate runoff from CM washdown, fire fighting, cleanup, etc.

d. Electrical power; 115 vac 60 cps. (Desirable, not mandatory, deactivation units contain their own power supply.)

e. Approximately 75 x 50 feet in area.

f. Contain an overhead crane (desirable, not mandatory).

g. Capable of supporting approximately 23,500 pounds. CM and dolly weigh approximately 15,500 pounds, deactivation units weigh approximately 8,100 pounds (wet). Command module weighs 12,039 pounds (3/27/67).

h. Floor (deck) must be paved-concrete (no oil or asphalt).

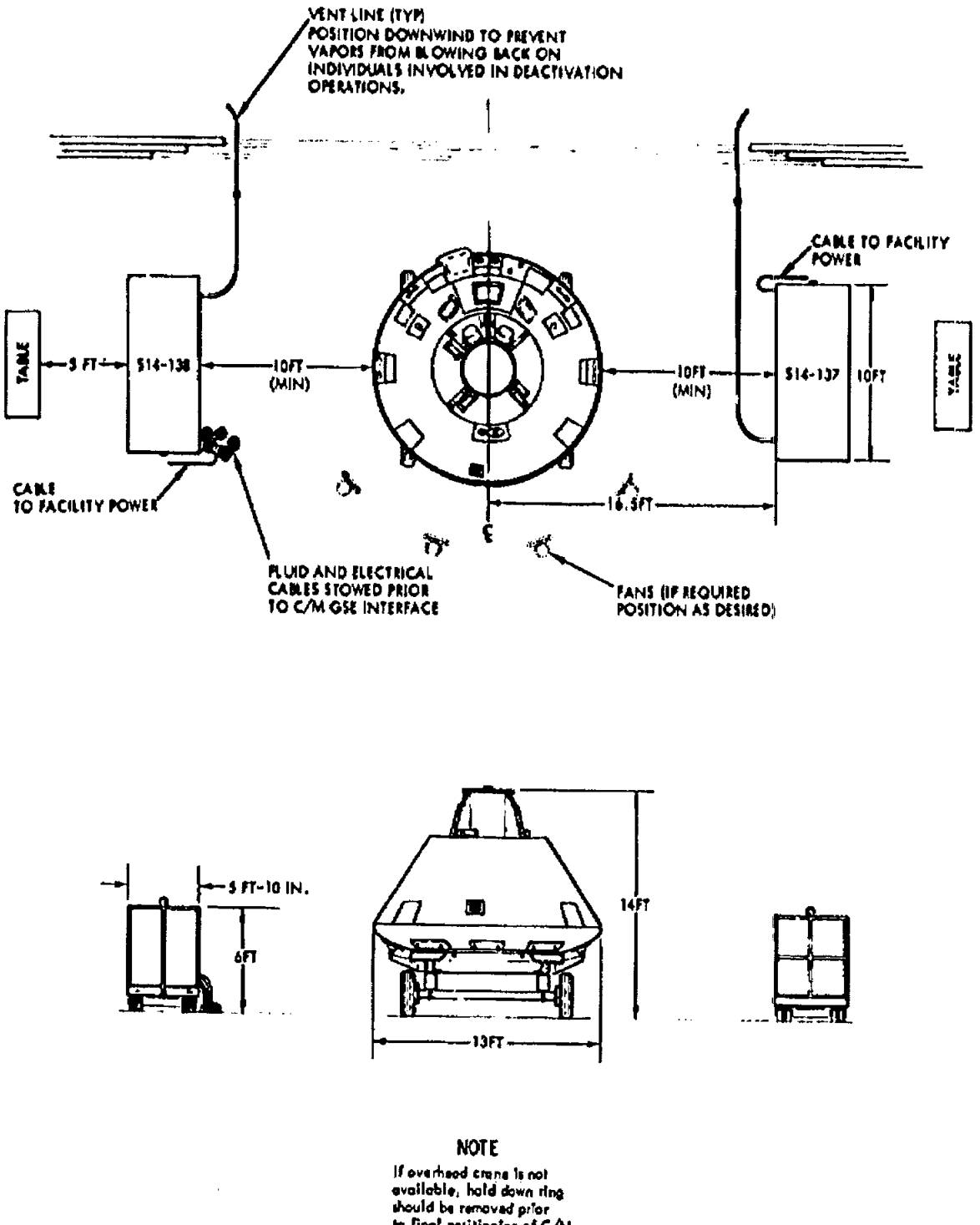

Figure 2-1. Deactivation Setup (Typical)

i. Capable of being closed to unauthorized personnel.

j. Contain a telephone (minimum of one).

k. Vertical clearance of at least 20 feet (minimum).

2-7. EQUIPMENT POSITIONING

2-8. Deactivation units as well as related equipment (vent lines, electrical connectors, etc.) shall be positioned as necessary to facilitate CM-GSE interface and deactivation operations. Figure 2-1 illustrates a typical deactivation setup.

2-9. EQUIPMENT ASSEMBLY

2-10. Paragraphs 2-11 through 2-16 provide information relative to preparing equipment utilized in conjunction with deactivation operations. Paragraph 2-19 provides setup and operating instructions for the Billion-Aire vapor detectors.

2-11. GROVER PUMP

2-12. Two stainless steel (except handle) Grover hand-operated pumps (model 3790-SS) are provided with each deactivation unit (figure 2-2). Each pump is provided with a 2-inch NPT adapter, extension tube, and spout

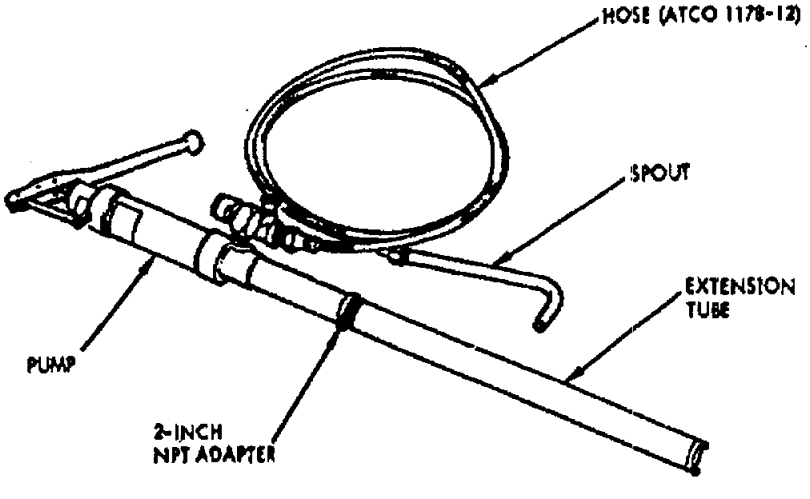

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Figure 2-2. Grover Pump

assembly; thereby, providing the capability of pumping directly from closed-top 55-gallon containers. To assemble pump, proceed as follows:

a. Detach curved spout from pump.

b. Attach ATCO 1178-12 hose directly to pump.

c. Attach curves spout to free end of hose.

2-13. OXIDIZER OVERBOARD DUMP HOSES

NOTE

These hoses are required only in the event of a pad or low-altitude abort.

2-14. Assemble M666000-12-0240 hose and valve assembly (figure 2-3) for oxidizer overboard dump connections, proceed as follows:

a. Fit on MS24392C12 connector to both ends of ME284-8061-0106 valve. Use 1155001-912 O-ring for connections.

b. On one end of valve, attach hose for connection to overboard dump fittings.

c. Connector on other end of valve attaches to fluid line (P/N G16-848613) supplied with deactivation unit.

NOTE

Two hose and valve assemblies are required for connection to CM RCS oxidizer panel overboard dump fitting.

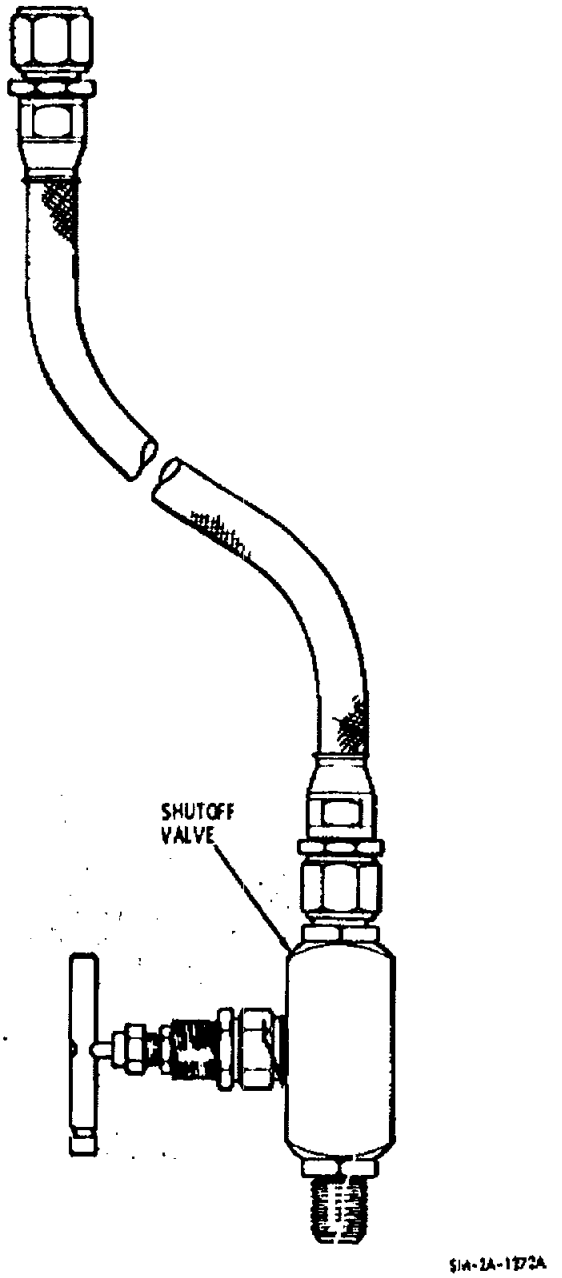

Figure 2-3. Oxidizer Overboard Dump Hose

2-15. HOKE BOTTLES

2-16. Four stainless steel Hoke bottles (figure 2-4) are provided with each deactivation unit. A series of valves and fittings, located on each end of the cylinders, provide a means for obtaining gas samples as well as purging individual bottles.

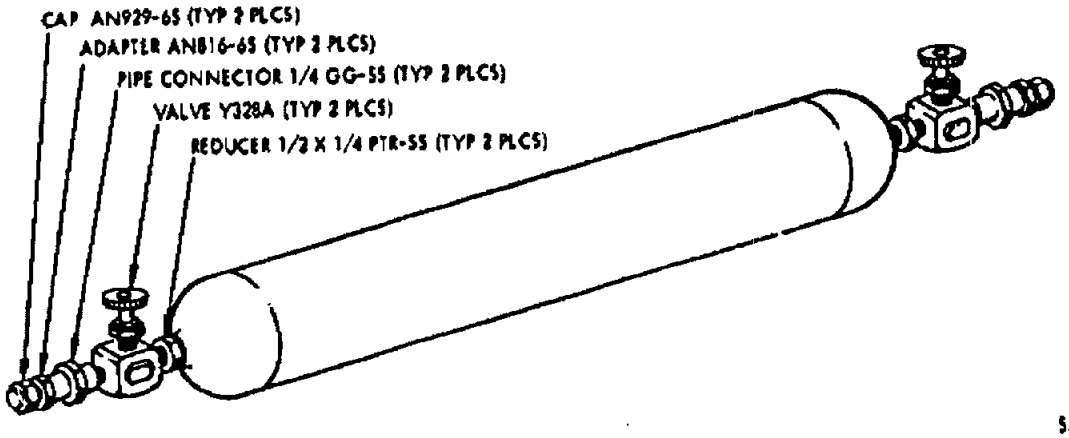
CAP AN929-6S (TYP 2 PLCS)
ADAPTER AN816-6S (TYP 2 PLCS)
PIPE CONNECTOR 1/4 GG-SS (TYP 2 PLCS)
VALVE Y328A (TYP 2 PLCS)
REDUCER 1/2 X 1/4 PTR-SS (TYP 2 PLCS)
SM-2A-1145

Figure 2-4. Hoke Bottle

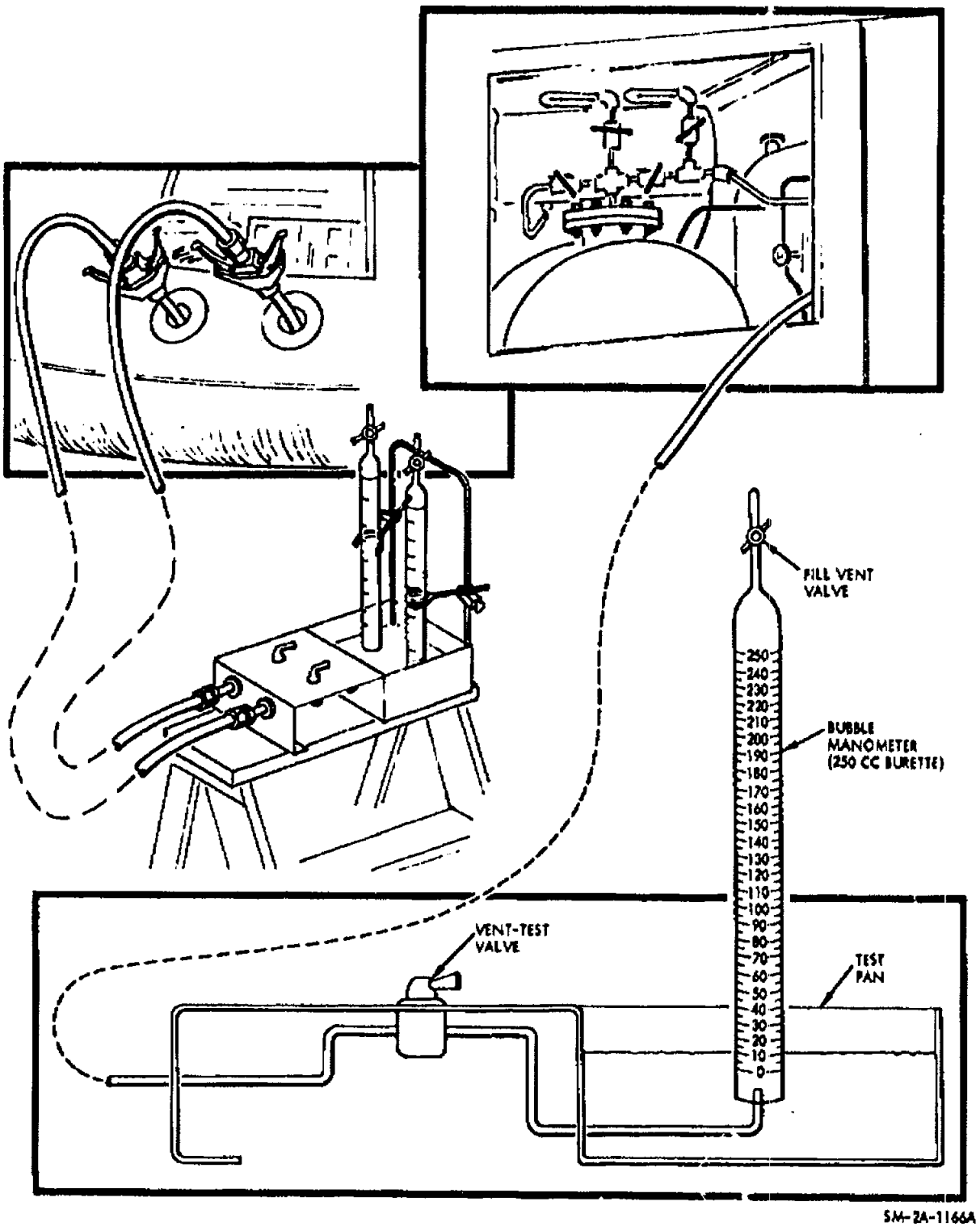

Figure 2-5. Leak Tester (Detector)

2-17. LEAK TESTER

2-18. The leak tester is comprised of a test pan, two 250 cc bubble manometers, and the necessary tygon tubing as shown in figure 2-5. The leak tester is used to check the propellant bladders and engine injector valves for leaks by applying nitrogen pressure and measuring the displaced water in a manometer for a rate of leakage.

2-18.1. If a leak is present in a re-inflated bladder, the nitrogen gas will be directed from the CM RCS helium vent test port to the sample port of the deactivation unit where it is detected and measured by the leak tester. When checking for injector valve leaks, the nitrogen pressure is applied to the backside of the valve and the leak tester is attached directly to the engine combustion chamber. A bladder or injector valve leak will lower the water level in the bubble manometer. Consequently, by measuring the droppage over a given time, the leakage rate is established. The water level in the bubble manometer must be recorded at the start of each leak test and again when the test is completed. The difference in readings must be calculated and recorded on the line representing the total leakage.

2-18A. LEAK TESTER SETUP. When the leak tester is properly set up, the test pan is filled about three-fourths full with water and the bubble manometer is filled with water to the 250 cc mark. The fill-vent valve on the stem is closed, and the mouth of the manometer is submerged and supported in place over the neck of the tester line. The VENT-TEST valve of the test pan has two positions. The TEST (open) position is selected only during timed intervals to determine a rate of leakage. The VENT position allows the gases to escape overboard.

2-18A.1. To fill the bubble manometer, it is inverted and water is poured into the mouth. When filled, the mouth is closed off while the manometer is being inverted and submerged. The fill-vent valve is normally closed; however, it must be opened when lowering the water level by blowing air into the stem and also while raising the water level by applying suction.

2-19. BILLION-AIRE VAPOR DETECTOR

2-20. Two portable Billion-Aire analyzers (figure 2-6) are provided for utilization by the LST during deactivation and safing operations. One detector shall be utilized to sense fuel vapors, the other for oxidizer. Accordingly, since fuel and oxidizer deactivation operations are conducted at separate intervals, only one unit will be in use at a time.

NOTE

Downey LST members utilize Billion-Aire analyzers; KSC LST members utilize equivalent analyzers provided locally.

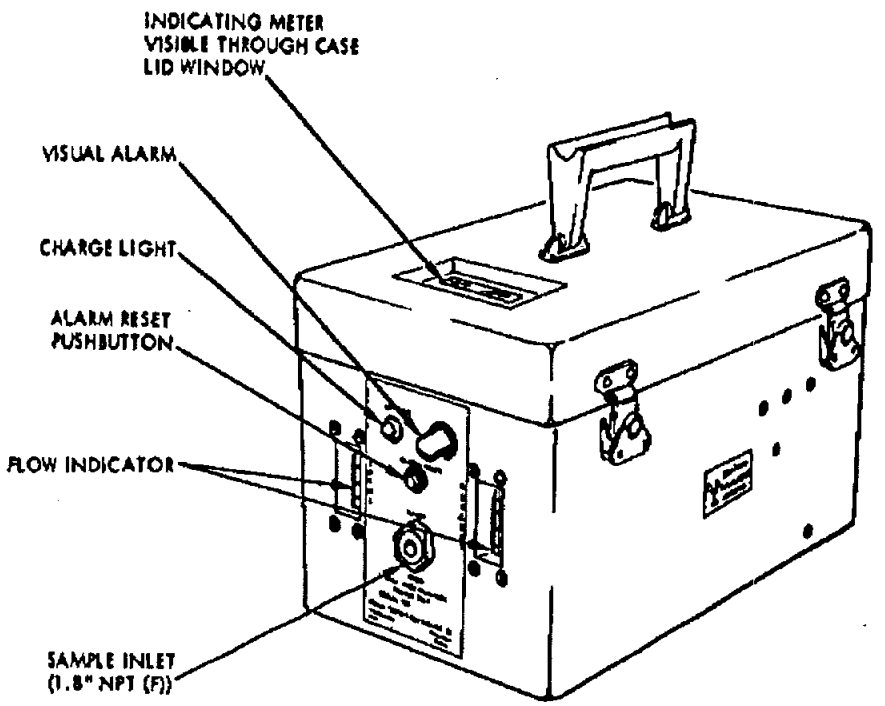

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Figure 2-6. Vapor Detector (Sheet 1 of 2)

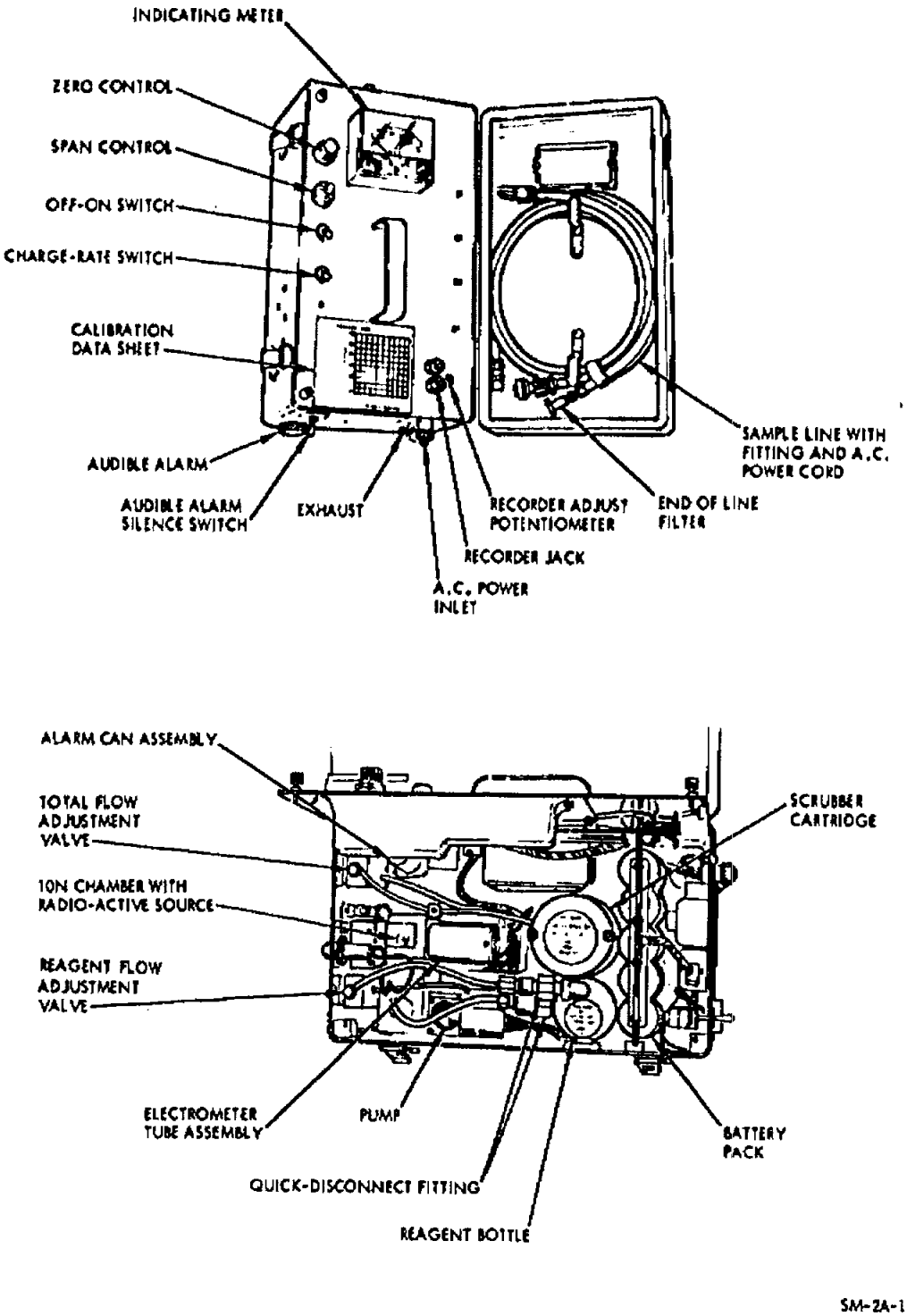

Figure 2-6. Vapor Detector (Sheet 2 of 2)

2-21. RADIOLOGICAL INFORMATION

2-22. A metal foil containing about 150 micrograms of radium is fastened to the inner wall of the ion chamber and is the ionization source. The radium is primarily an alpha emitter with the range of the alphas being a few centimeters in air. No alphas can escape the closed chamber. The radium disintegrations are accompanied by gamma emission; however, the gamma flux within twelve inches of the chamber surface remains below the average permissible dose rate of 2.5 millirem per hour. Since this rate is derived from the whole body exposure limits, normal handling of the instrument and occasional intimacy of the hands with the external surface of the ion chamber poses little radiation hazard.

WARNING

- The ingestion or inhalation of radioactive debris due to inadvertent rupture of the sealed source (by the insertion of tools or the use of abrasive cleaners on the internal surface of the ion chamber) can be hazardous.
- The ion chamber shall not be removed by LST members.
- No attempt shall be made to repair the chamber containing radioactive material during field use.

2-23. OPERATION AND SERVICING

NOTE

- Upon custodial transfer for deployment, the Team Leader shall assure that a radioactive material wipe test has been accomplished within the preceding 6 months and that these tests will not fall due prior to completion of the deactivation operations.
- Incidents which lead the Team Leader to believe damage has occurred to a radioactive source will be cause to cease operation of the instrument and immediately notify the NAA Radiological Safety Officer.

2-24. Utilize loose-leaf operating instructions provided by Safety, Dept. 20 (NAA, SD).

2-25. SERVICING DEACTIVATION UNITS

2-26. Prior to servicing the deactivation units it is recommended that the various switches, valves, etc., be positioned as indicated in paragraphs 2-29 (S14-137) and 2-36 (S14-138). Following verification and/or positioning of the various switches and valves, proceed with servicing operations as outlined in paragraphs 2-30 through 2-33 (S14-137) and 2-37 through 2-40 (S14-138).

2-27. S14-137 FUEL DEACTIVATION UNIT

2-28. The S14-137 is a self-contained unit, designed for the purpose of purging the CM RCS with gaseous nitrogen and alcohol, and receiving residual fuel following flight. Major components of the S14-137 are: flushing, scrubber, and collector tanks; electrical and fluid control panels (valves/switches); vacuum pump, AC-DC converter, batteries, liquid trap, flexible hose assemblies and electrical cables. Flexible hose and electrical cable assemblies provide the required interface between the CM RCS and deactivation unit.

2-29. CONTROLS AND INDICATORS. On the S14-137, perform the following procedures:

a. Inside the unit, close the following valves:

G42MV4	G34MV1
G42MV7	G34MV2
G45MV1	G34MV3
G45MV2	G34MV4
G50MV4	

b. Verify the following relief valves contain current calibration stamps:

G4RV1	G45RV1
G4RV2	G50RV1

c. On the RCS PROPELLANT DEACTIVATION UNIT panel (figure 2-7), perform the following steps:

1. Turn ALCOHOL TANK PRESSURE REGULATOR (G4PR1) to DECR (fully counterclockwise).

2. Turn NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to DECR (fully counterclockwise).

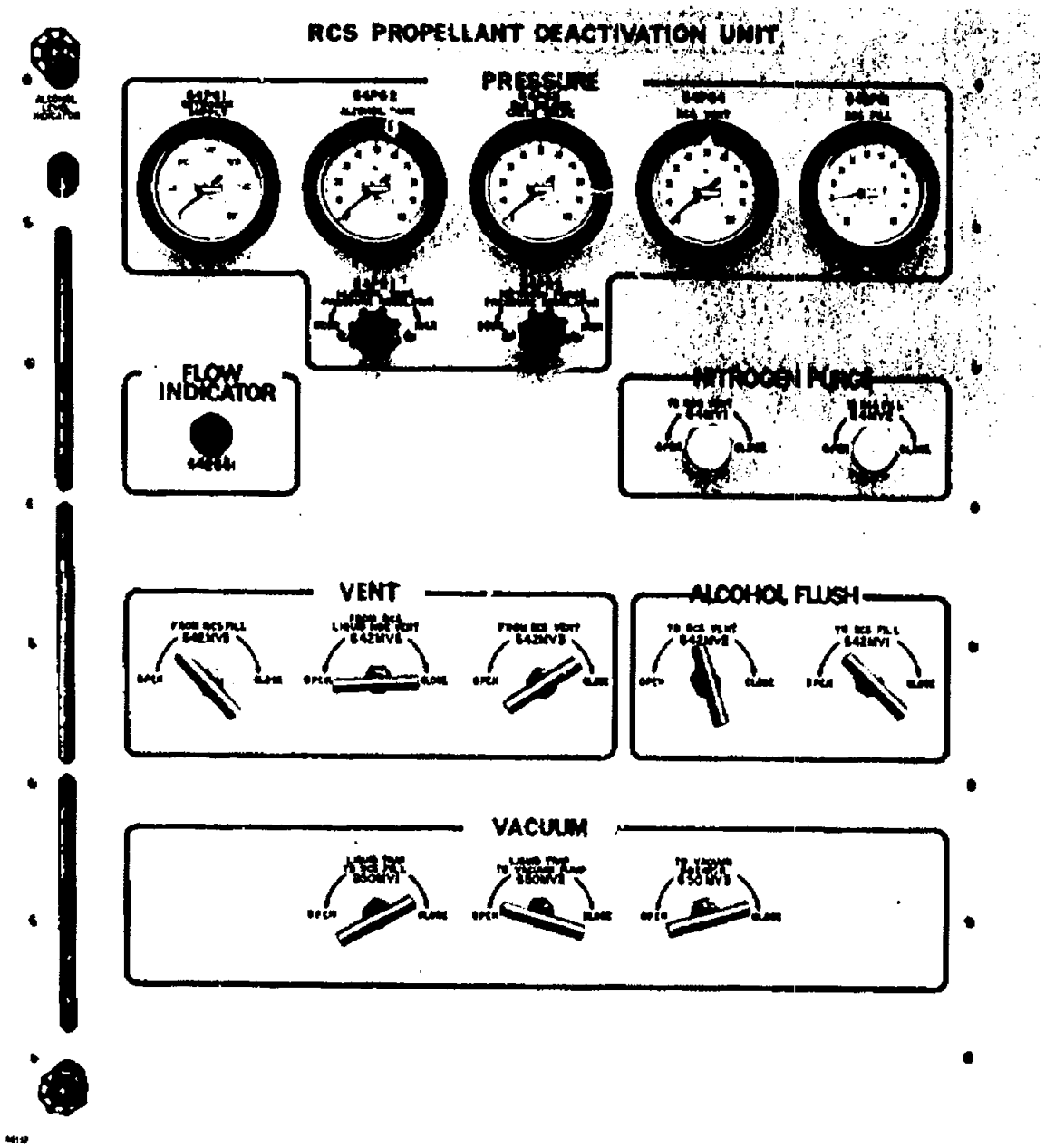

Figure 2-7. S14-137 RCS Propellant Deactivation Unit Panel

3. Close NITROGEN PURGE, VENT, ALCOHOL FLUSH, and VACUUM valves, in the following sequence:

NITROGEN PURGE

G4MV1
G4MV2

VENT

G42MV5
G42MV6
G42MV3

ALCOHOL FLUSH

G42MV2
G42MV1

VACUUM

G50MV1
G50MV2
G50MV3

d. Position controls on RCS VALVE CONTROL - SYSTEM A and - SYSTEM B panels (figure 2-8) as follows:

1. Set SYSTEM A-ISOLATION VALVE RESET-OFF switch to OFF.

2. Set SYSTEM B-ISOLATION VALVE RESET-OFF switch to OFF.

3. Set SYSTEM A- and SYSTEM B-OPEN-CLOSE switches (C19B1 through C19B12) to CLOSE.

e. Position controls on RCS VALVE CONTROL-POWER CONTROL panel as follows:

1. Set VACUUM PUMP ON-OFF switch to OFF.

2. Set AC-DC EMERGENCY CONTROL switch to STOP.

3. Set 28 VDC-RESET and -POWER SUPPLY switches to OFF.

4. Set 115 VAC switch to OFF (center position).

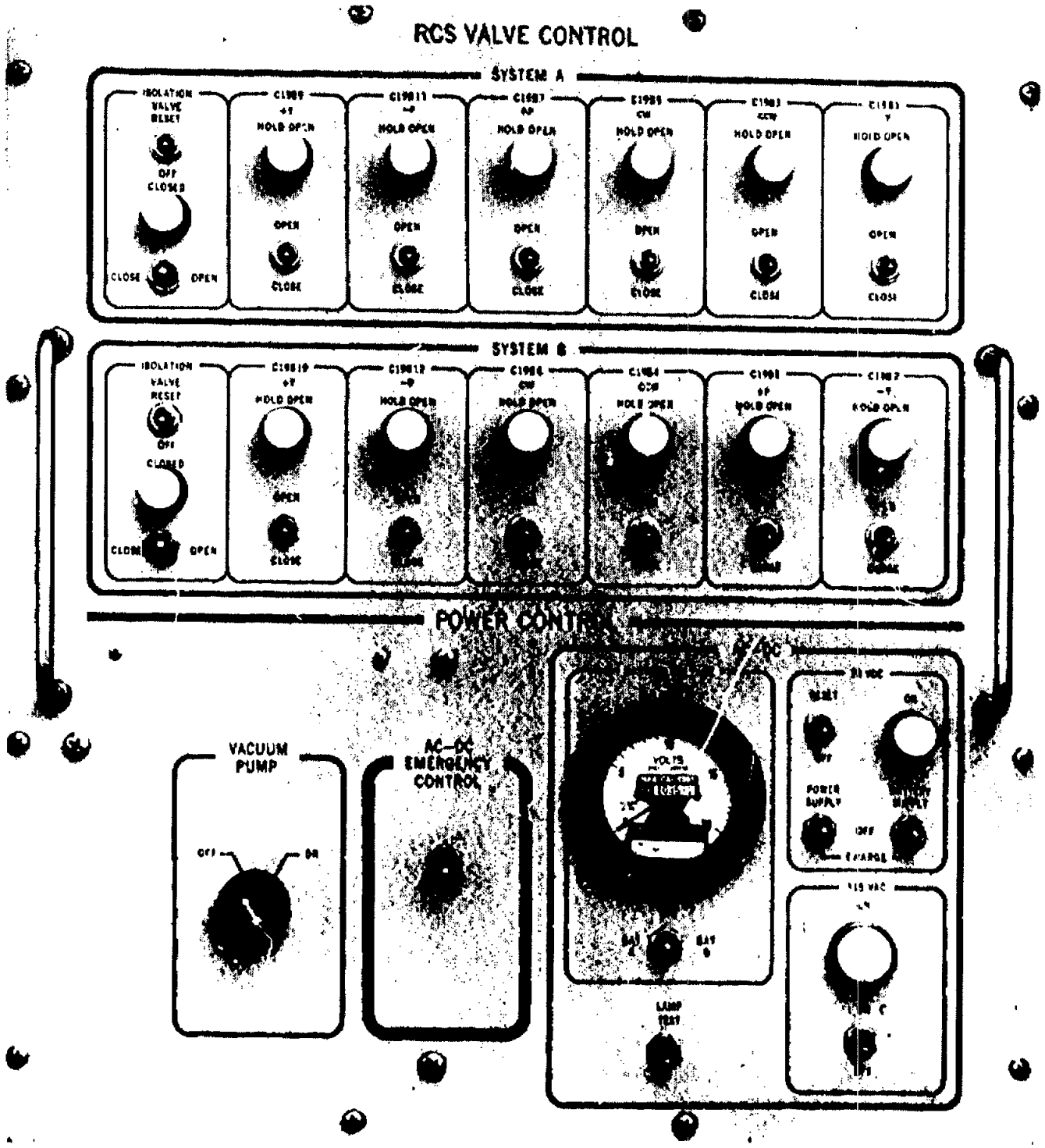

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Figure 2-8. S14-137 RCS Valve Control Panel

5. Set 28 VDC-BATTERY SUPPLY switch to CHARGE.

6. Set BATTERY VOLTAGE switch to BAT A; BATTERY VOLTAGE meter should read 12.4 vdc.

7. Set BATTERY VOLTAGE switch to BAT B; BATTERY VOLTAGE meter should read 12.4 vdc.

8. Set BATTERY VOLTAGE switch to OFF.

9. Set 28 VDC-BATTERY SUPPLY switch to OFF.

f. Open ALCOHOL LEVEL INDICATOR valves located above and below sight gage.

2-30. K-BOTTLE INSTALLATION. Five K-bottles containing GN_2 (MIL-P-27401) shall be installed in the S14-137 as follows:

a. Position K-bottles within deactivation unit. (See figure 2-9).

b. Using hook assemblies, install securing cable.

c. Remove K-bottle safety caps. Verify valve assemblies are closed.

d. Attach G16-848762 fittings to K-bottle valve assemblies.

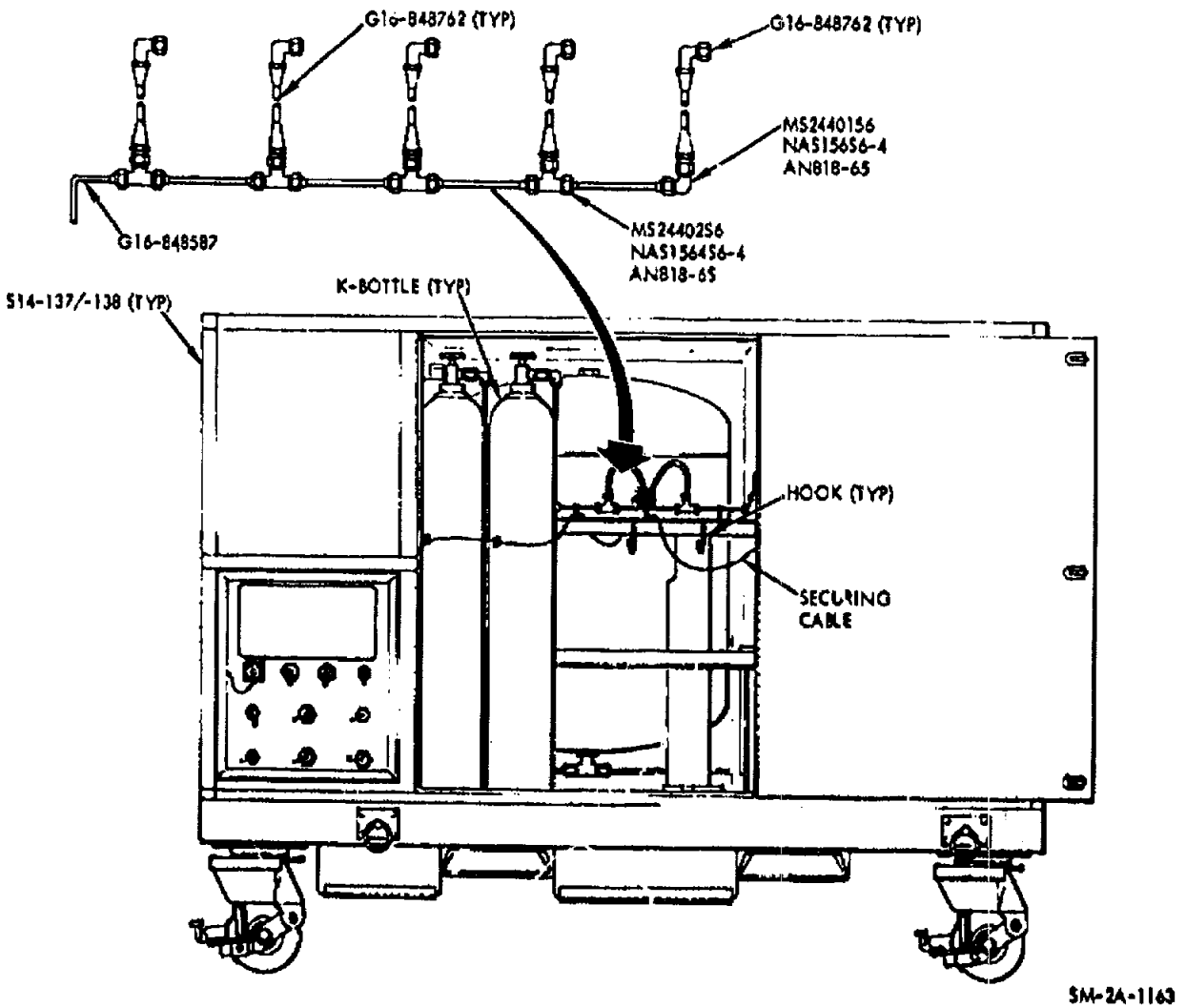

Figure 2-9. K-Bottle Installation

2-31. SERVICING FLUSHING TANK. Service the S14-137 flushing tank (G42TK1) with 150 gallons of alcohol (Fed Spec TTI-735 grade A) as follows (figure 2-10):

a. Remove cap from fill opening located on top side of flushing tank.

b. Install Grover pump (model 3790-SS) into bung of drum containing alcohol.

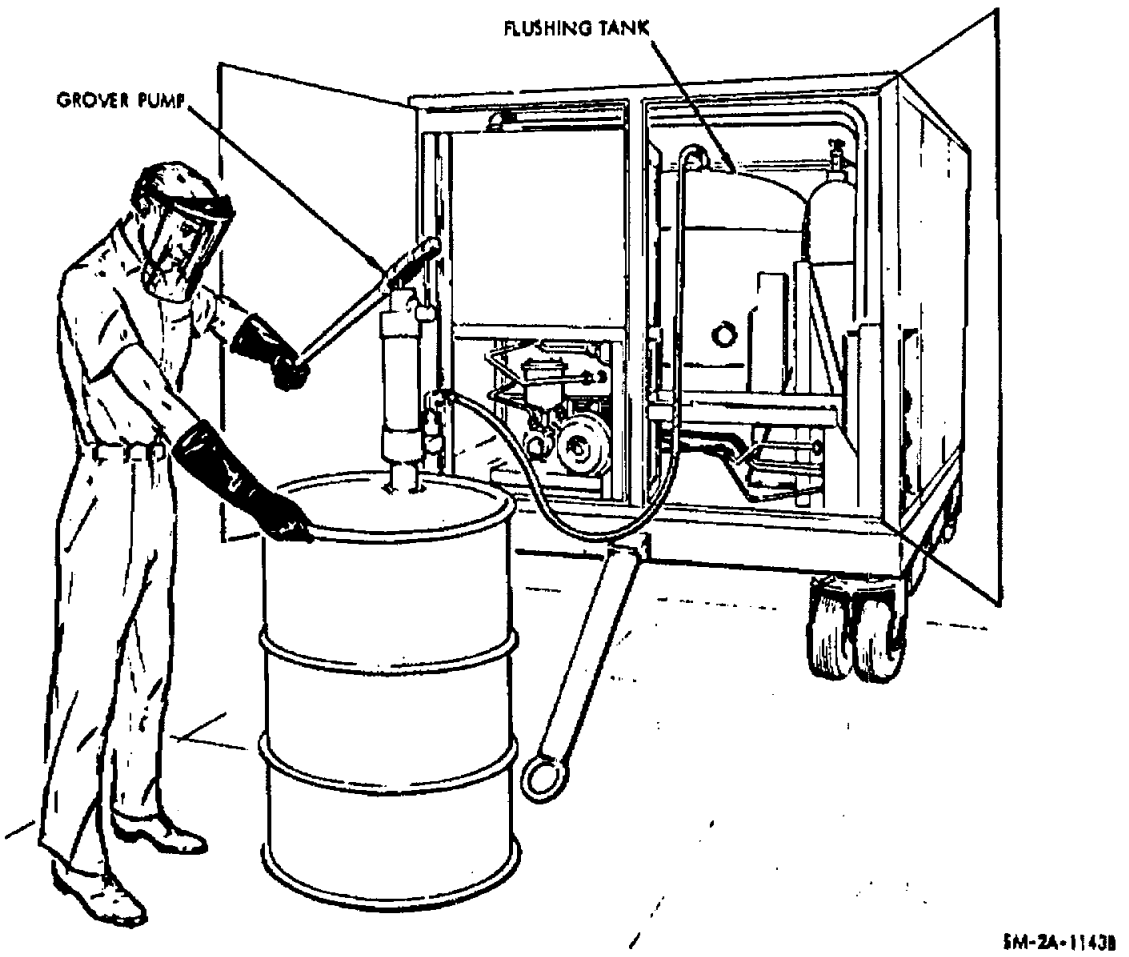

Figure 2-10. Servicing Flushing Tank

NOTE

Refer to paragraph 2-11 for assembly instructions.

c. Insert curved spout on pump hose into flushing tank fill opening.

d. Pump 150 gallons of alcohol into flushing tank.

NOTE

Monitor fluid level on ALCOHOL LEVEL INDICATOR.

e. Remove curved spout from flushing tank; reinstall cap and secure pump.

2-32. SERVICING COLLECTOR TANK. The S14-137 collector tank (G34TK1) shall be serviced with 2 gallons of alcohol, prior to securing the pump and drum utilized to service the flushing tank (paragraph 2-31).

NOTE

Collector tank servicing shall be at the discretion of the LST Director; accordingly, verify servicing requirement prior to performing steps a through e.

a. Remove G16-848806 line assembly interconnecting collector tank and G32MV2 valve. (See figure 2-11.)

b. Install short section of 3/4-inch hard line to tank elbow.

c. Interconnect hard line and spout with a section of 3/4-inch tygon tubing.

d. Pump 2 gallons of alcohol (Fed Spec TTI-735 grade A) into collector tank.

NOTE

Monitor fluid level on sight gage.

e. Remove fill line assembly; reinstall G16-848806 line assembly and secure pump.

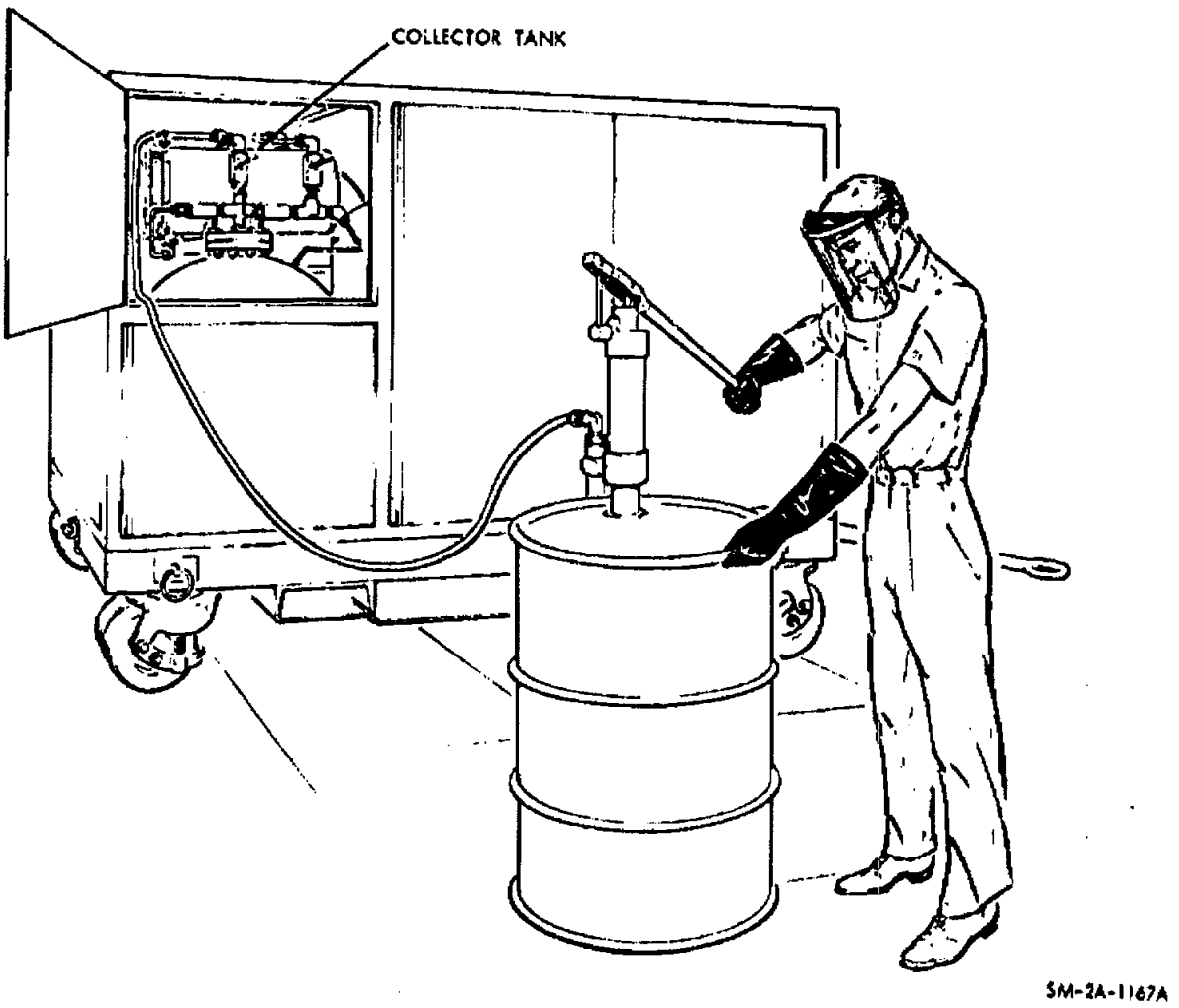

Figure 2-11. Servicing Collector Tank

2-33. SERVICING SCRUBBER TANK. Service the S14-137 scrubber tank (G45TK1) with 30 gallons of neutralizer (10 gallons of Del Chem 2302C and 20 gallons of distilled water).

NOTE

- Neutralizer is a 2:1 solution; 1 part Del Chem 2302C and 2 parts distilled water.
- Principal constituent: hydroxyacedic acid.

a. Remove G17-854762-63 line assembly interconnecting scrubber tank and G50MV4 valve. (See figure 2-12.)

NOTE

Retain O-ring for reinstallation upon completion of servicing operation.

b. Install Grover pump (model 3790-SS) into bung of drum containing Del Chem 2302C.

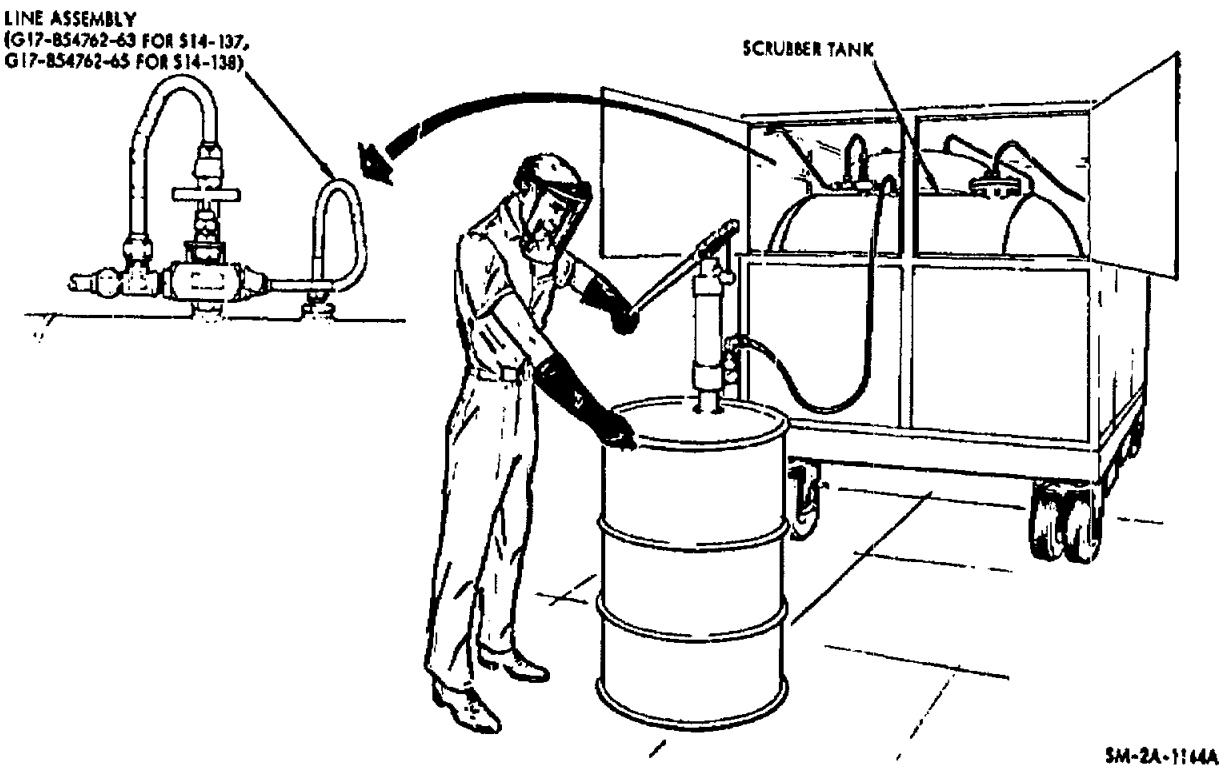

Figure 2-12. Servicing Scrubber Tank

NOTE

Refer to paragraph 2-11 for assembly instructions.

c. Insert curved spout on pump hose into fill opening provided by step a.

d. Pump 10 gallons of Del Chem 2302C into scrubber tank.

e. Remove curved spout from scrubber tank; secure pump assembly.

f. Install another Grover pump into bung of drum containing distilled water.

g. Insert curved spout on pump hose into fill opening provided by step a.

h. Pump 20 gallons of distilled water into scrubber tank.

i. Remove curved spout from scrubber tank; secure pump assembly and reinstall plumbing. Use O-ring previously removed in step a.

2-34. S14-138 OXIDIZER DEACTIVATION UNIT

2-35. The S14-138 is a self-contained unit, designed for the purpose of purging the CM RCS with gaseous nitrogen and freon, and receiving residual oxidizer following flight. Major components of the S14-138 are: flushing, scrubber, and collector tanks; electrical and fluid control panels (valves/switches); vacuum pump, AC-DC converter, batteries, liquid trap, flexible hose assemblies, and electrical cables. Flexible hose and electrical cable assemblies provide the required interface between CM-RCS and deactivation unit.

2-36. CONTROLS AND INDICATORS. On the S14-138, perform the following procedures:

a. Inside the unit, close the following valves:

G42MV4	G32MV1
G42MV7	G32MV2
G45MV1	G32MV3
G45MV2	G32MV4
G50MV4	

b. Verify the following relief valves contain current calibration stamps:

G4RV1	G45RV1
G4RV2	G50RV1

c. On the RCS PROPELLANT DEACTIVATION UNIT panel, perform the following steps (figure 2-13):

1. Turn FREON TANK PRESSURE REGULATOR (G4PR1) to DECR (fully counterclockwise).

2. Turn NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to DECR (fully counterclockwise).

3. Close NITROGEN PURGE, VENT, FREON FLUSH, and VACUUM valves in the following sequence:

NITROGEN PURGE

G4MV1
G4MV2

VENT

G42MV5
G42MV6
G42MV3

FREON FLUSH

G42MV2
G42MV1

VACUUM

G50MV1
G50MV2
G50MV3

d. Position controls on RCS VALVE CONTROL-SYSTEM A and - SYSTEM B panels as follows:

1. Set SYSTEM A-ISOLATION VALVE RESET-OFF switch to OFF.

2. Set SYSTEM B-ISOLATION VALVE RESET-OFF switch to OFF.

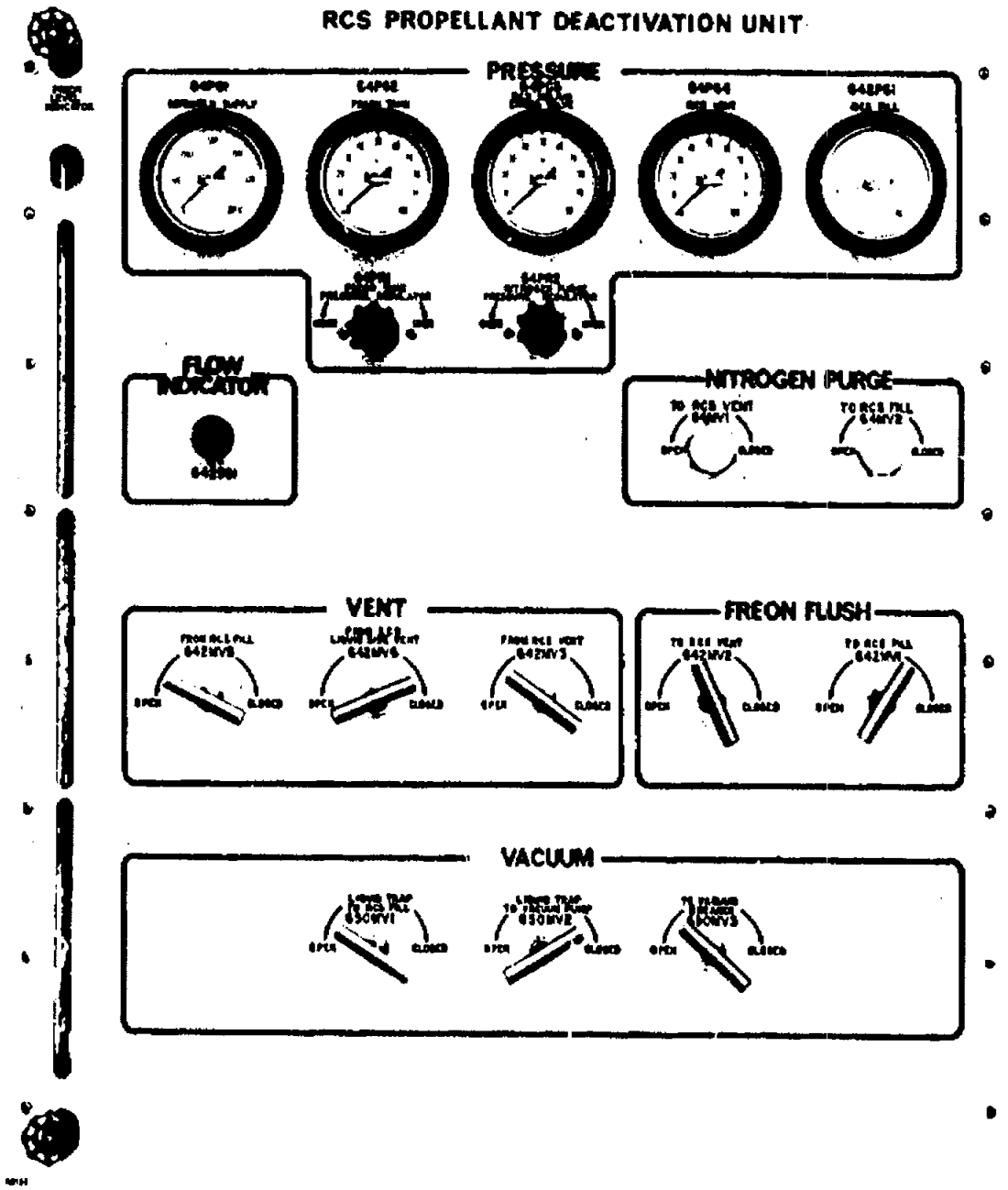

Figure 2-13. S14-138 RCS Propellant Deactivation Unit Panel

3. Set SYSTEM A- and SYSTEM B-OPEN-CLOSE switches (C19B1 through C19B12) to CLOSE.

e. Position controls on RCS VALVE CONTROL—POWER CONTROL panel as follows (figure 2-14):

1. Set VACUUM PUMP ON-OFF switch to OFF.

2. Set AC-DC EMERGENCY CONTROL switch to STOP.

3. Set 28 VDC-RESET and -POWER SUPPLY switches to OFF.

4. Set 115 VAC switch to OFF (center position).

5. Set 28 VDC-BATTERY SUPPLY switch to CHARGE.

6. Set BATTERY VOLTAGE switch to BAT A; BATTERY VOLTAGE meter should read 12.4 vdc.

7. Set BATTERY VOLTAGE switch to BAT B; BATTERY VOLTAGE meter should read 12.4 vdc.

8. Set BATTERY VOLTAGE switch to OFF.

9. Set 28 VDC-BATTERY SUPPLY switch to OFF.

f. Open ALCOHOL LEVEL INDICATOR valves located above and below sight gage.

2-37. K-BOTTLE INSTALLATION. Five K-bottles containing N_2 (MIL-P-27401) shall be installed in the S14-138. Installation instructions are identical to those provided for the S14-137; accordingly, refer to paragraph 2-30.

2-38. SERVICING FLUSHING TANK. Service the S14-138 flushing tank (G42TK1) with 150 gallons of freon TF (Federal Specification MB0210-005) as follows:

NOTE

Figure 2-10 illustrates a typical servicing operation.

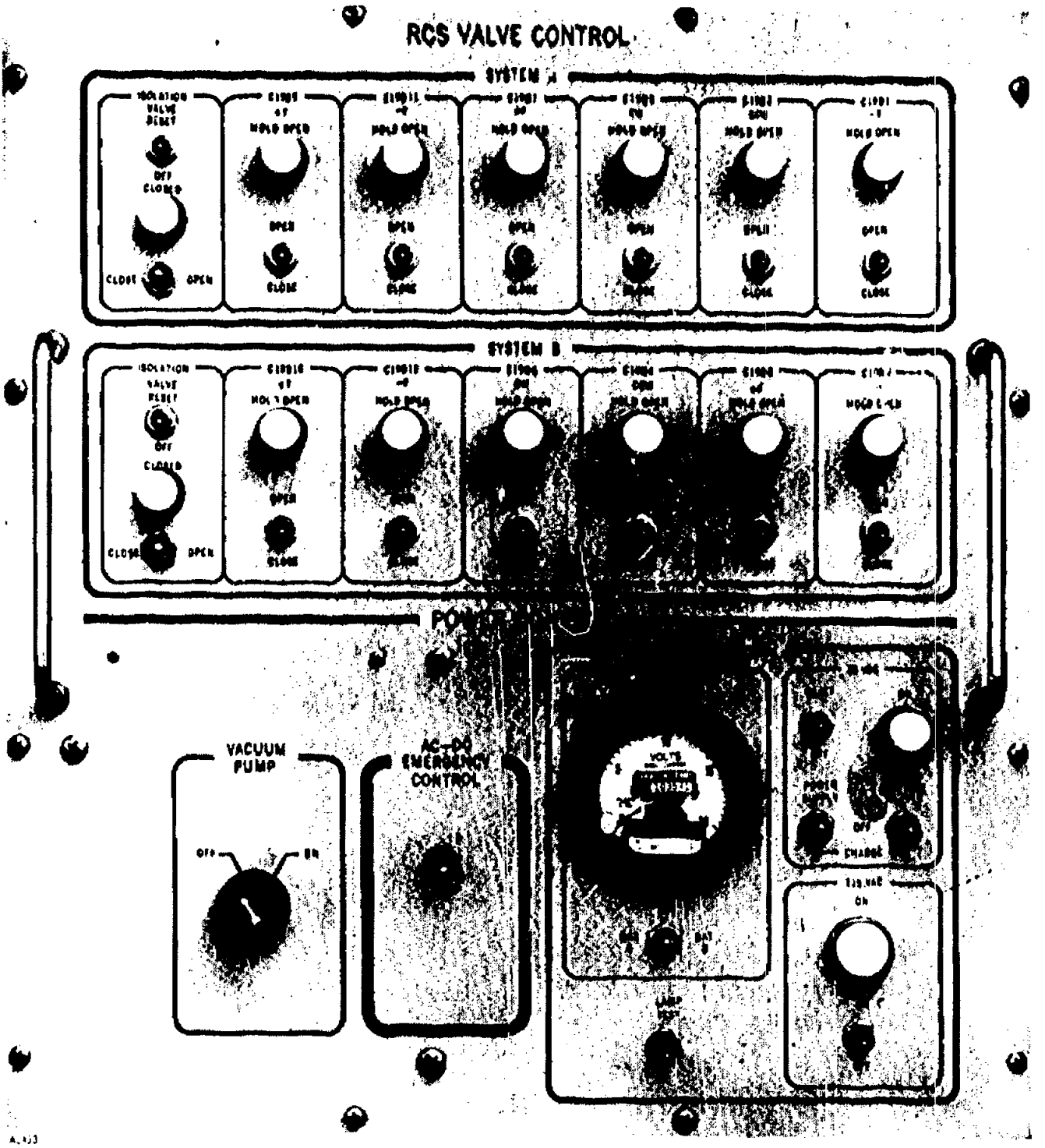

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Figure 2-14. S14-138 RCS Valve Control Panel

a. Remove cap from fill opening located on top side of flushing tank.

b. Install Grover pump (model 3790-SS) into bung of drum containing freon.

NOTE

Refer to paragraph 2-11 for assembly instructions.

c. Insert curved spout on pump hose into flushing tank fill opening.

d. Pump 150 gallons of freon into flushing tank.

NOTE

- Flow of freon may cause pump to freeze.
- Flushing tank may be filled from an elevated drum using gravity flow.
- Monitor fluid level on FREON LEVEL INDICATOR.

e. Remove curved spout from flushing tank; reinstall cap and secure pump.

2-39. SERVICING COLLECTOR TANK. The S14-138 collector tank (G32TK1) shall be serviced with 2 gallons of freon, prior to securing the pump and drum utilized to service the flushing tank (paragraph 2-38).

NOTE

Collector tank servicing shall be at the discretion of the LST Director; accordingly, verify servicing requirements prior to performing steps a through e.

a. Remove G16-848806 line assembly interconnecting collector tank and 32MV2 valve. (See figure 2-11.)

b. Install short section of 3/4-inch hard line to tank elbow.

c. Interconnect hard line and spout with a section of 3/4-inch tygon tubing.

d. Pump 2 gallons of freon into collector tank.

NOTE

Monitor fluid level on sight gage.

e. Remove fill line assembly; reinstall G16-848806 line assembly and secure pump.

2-40. SERVICING SCRUBBER TANK. Service the S14-138 flushing tank (G45TK1) with 30 gallons of neutralizer (10 gallons of Del Chem 2303C and 20 gallons of distilled water).

NOTE

- Neutralizer is a 2:1 solution; 1 part Del Chem 2303C and 2 parts distilled water.
- Principal constituent triethanolamine.

a. Remove G17-854762-65 line assembly interconnecting scrubber tank and G50MV4 valve. (See figure 2-12.)

NOTE

Retain O-ring for reinstallation upon completion of servicing operation.

b. Install Grover pump (model 3790-SS) into bung of drum containing Del Chem 2303C.

NOTE

Refer to paragraph 2-11 for assembly instructions.

c. Insert curved spout on pump hose into fill opening provided by step a.

d. Pump 10 gallons of Del Chem 2303C into scrubber tank.

e. Remove curved spout from scrubber tank, secure pump assembly.

f. Install another Grover pump into bung of drum containing distilled water.

g. Insert curved spout on pump hose into fill opening provided by step a.

h. Pump 20 gallons of distilled water into scrubber tank.

i. Remove curved spout from scrubber tank, secure pump assembly, and reinstall plumbing. Use O-ring previously removed in step a.

2-41. ELECTRICAL/FLUID LINE INSTALLATION

2-42. Electrical and fluid lines shall be attached to the deactivation units using standard shop practice. Figures 2-15 and 2-16 illustrate the various electrical and fluid lines associated with the S14-137. Figures 2-17 and 2-18 illustrate electrical and fluid lines associated with the S14-138.

WARNING

Always ground the deactivation units prior to applying external power. Use "GROUND LUG" located on each unit (figures 2-15 and 2-17).

2-43. Connect the fuel electrical cables and fluid lines to S14-137; connect the oxidzer electrical cables and fluid lines to S14-138 as indicated in the following tabulations:

FUEL
S14-137 ELECTRICAL CABLES

Cable	Part No.	Interface Connection	Figure Reference
W1	G16-848798-21	FACILITY 115 VAC 60 CPS POWER	2-15
W2	G16-848798-11	AC POWER-J1	2-15
W3	G16-848797-21	ISOLATION VALVE-J2	2-15
W4	G16-848786	SYSTEM A ENGINE VALVES-J3	2-15
W5	G16-880569-51	SYSTEM B ENGINE VALVES-J4	2-15

S14-137 FLUID LINES

Flex Hose Assy	Part No.	Interface Connection	Figure Reference
G4FH6	95625	RCS FUEL CHECK VALVES-HELIUM PANEL	2-16, 4-1, 6-1
G42FH1	95578	RCS FUEL VENT	2-16, 4-1, 6-1
G42FH2	95580	FUEL LIQUID SIDE VENTS	2-16, 4-1, 6-1
G42FH3	G16-848826-3	TEST POINTS FUEL PANEL	2-16, 4-1, 6-1

Flex Hose Assy	Part No.	Interface Connection	Figure Reference
G42FH4	95580	RCS FUEL FILL	2-16, 4-1, 6-1
G42FH5	G16-848824-3	RCS ENGINES	2-16, 4-1, 6-1
G45FH1	G16-848821-3	VENT PORT	2-16, 4-1, 6-1

OXIDIZER
S14-138 ELECTRICAL CABLES

Cable	Part No.	Interface Connection	Figure Reference
W1	G16-848798-21	FACILITY 115 VAC 60 CPS POWER	2-17
W2	G16-848798-11	AC POWER-J1	2-17
W3	G16-848797-11	ISOLATION VALVE-J2	2-17
W4	G16-848789	SYSTEM A ENGINE VALVES-J3	2-17
W5	G16-880569-41	SYSTEM B ENGINE VALVES-J4	2-17

S14-138 FLUID LINES

Flex Hose Assy	Part No.	Interface Connection	Figure Reference
G4FH6	95625	RCS OXID CHECK VALVES HELIUM PANEL	2-18, 5-1, 7-1
G42FH1	95579	RCS OXID VENT	2-18, 5-1, 7-1
G42FH2	95581	OXID LIQUID SIDE VENTS	2-18, 5-1, 7-1
G42FH3	G16-848826-5	TEST POINT OXID PANEL	2-18, 5-1, 7-1
G42FH4	95581	RCS OXID FILL	2-18, 5-1, 7-1
G42FH5	G16-848824-5	RCS ENGINES	2-18, 5-1, 7-1
G45FH1	G16-848821-5	VENT PORT	2-18, 5-1, 7-1

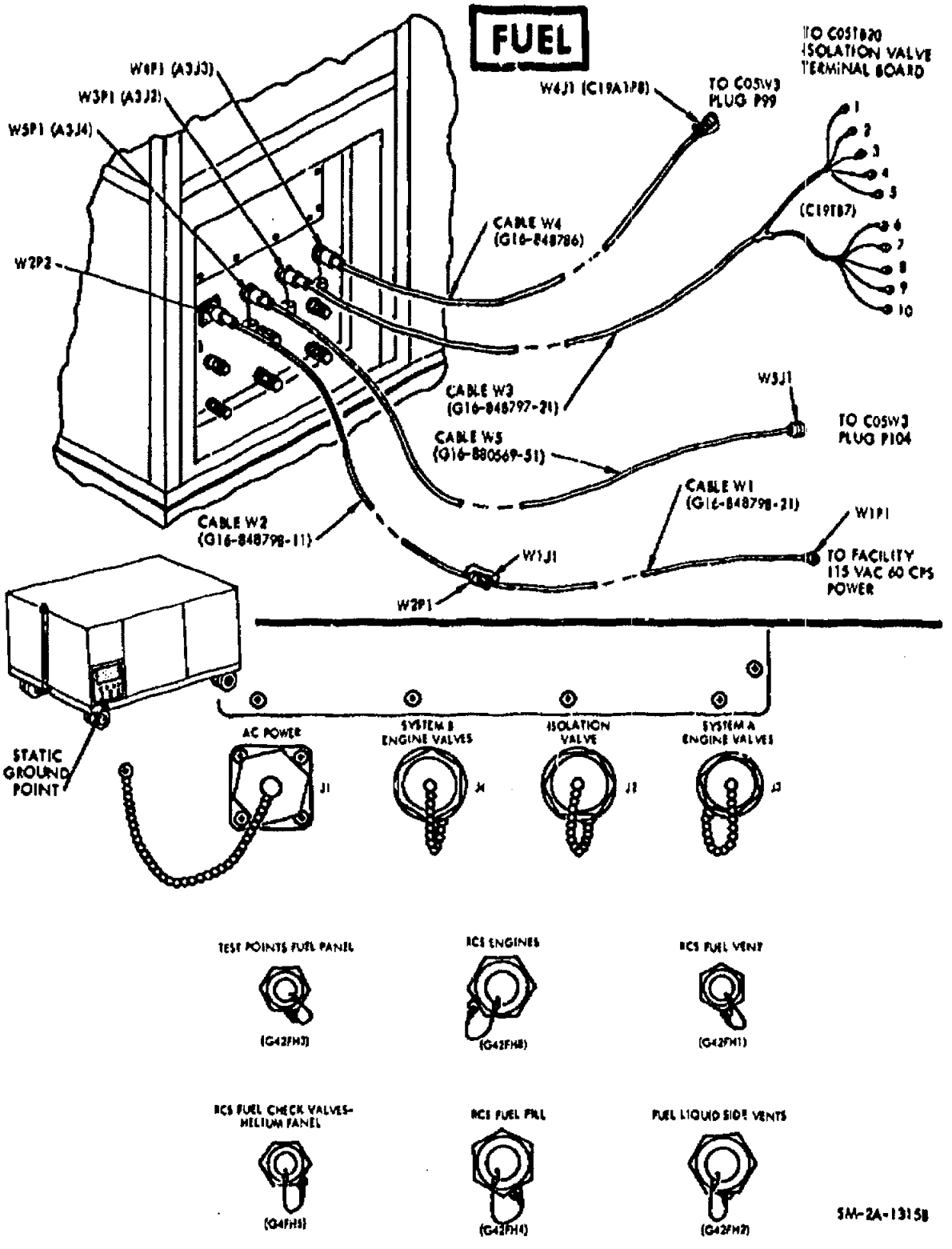


Figure 2-15. S14-137 Systems A and B Electrical Cables - Fuel (Sheet 1 of 2)

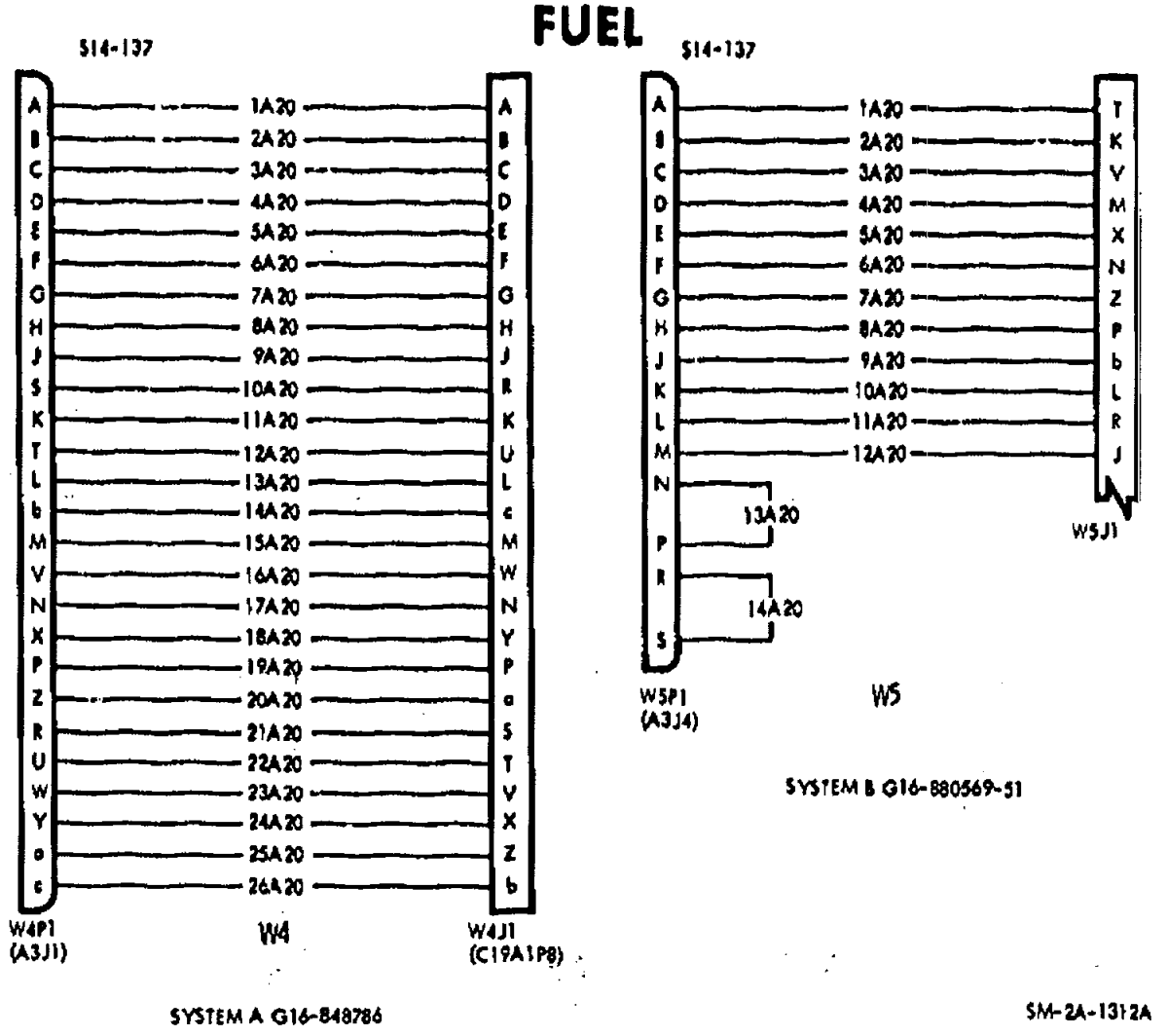
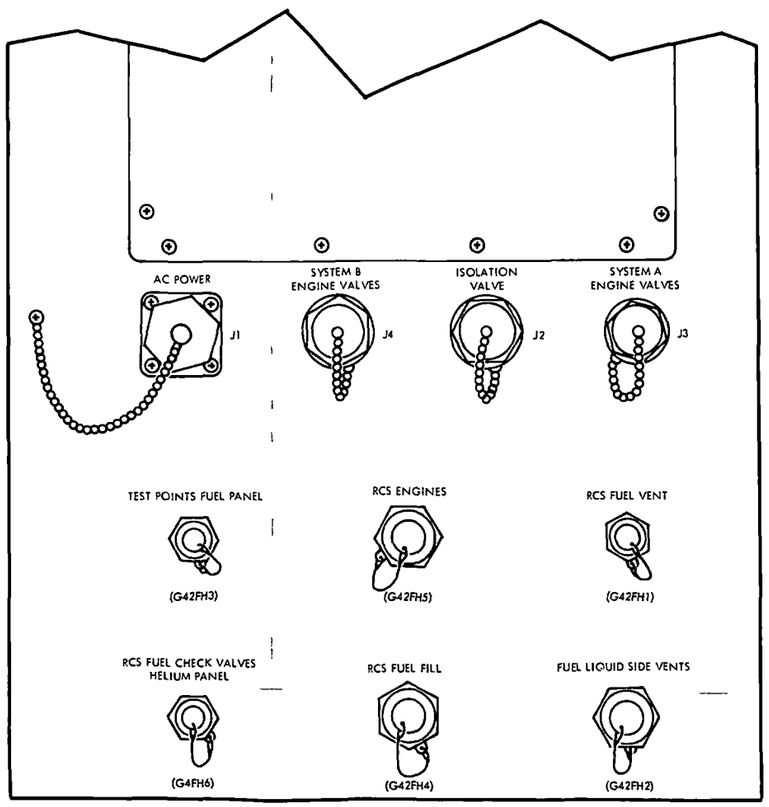
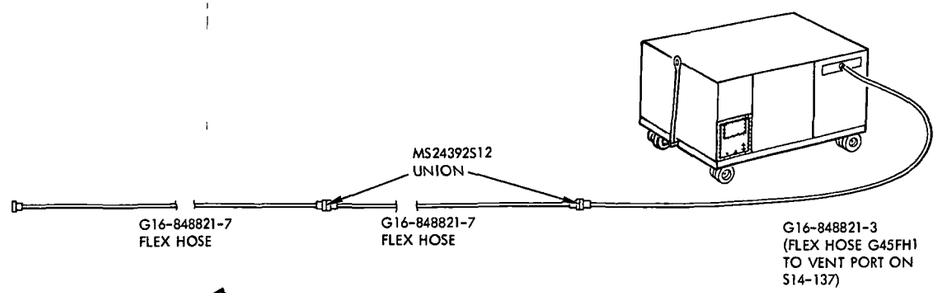


Figure 2-15. S14-137 Systems A and B Electrical Cables - Fuel (Sheet 2 of 2)





FUEL

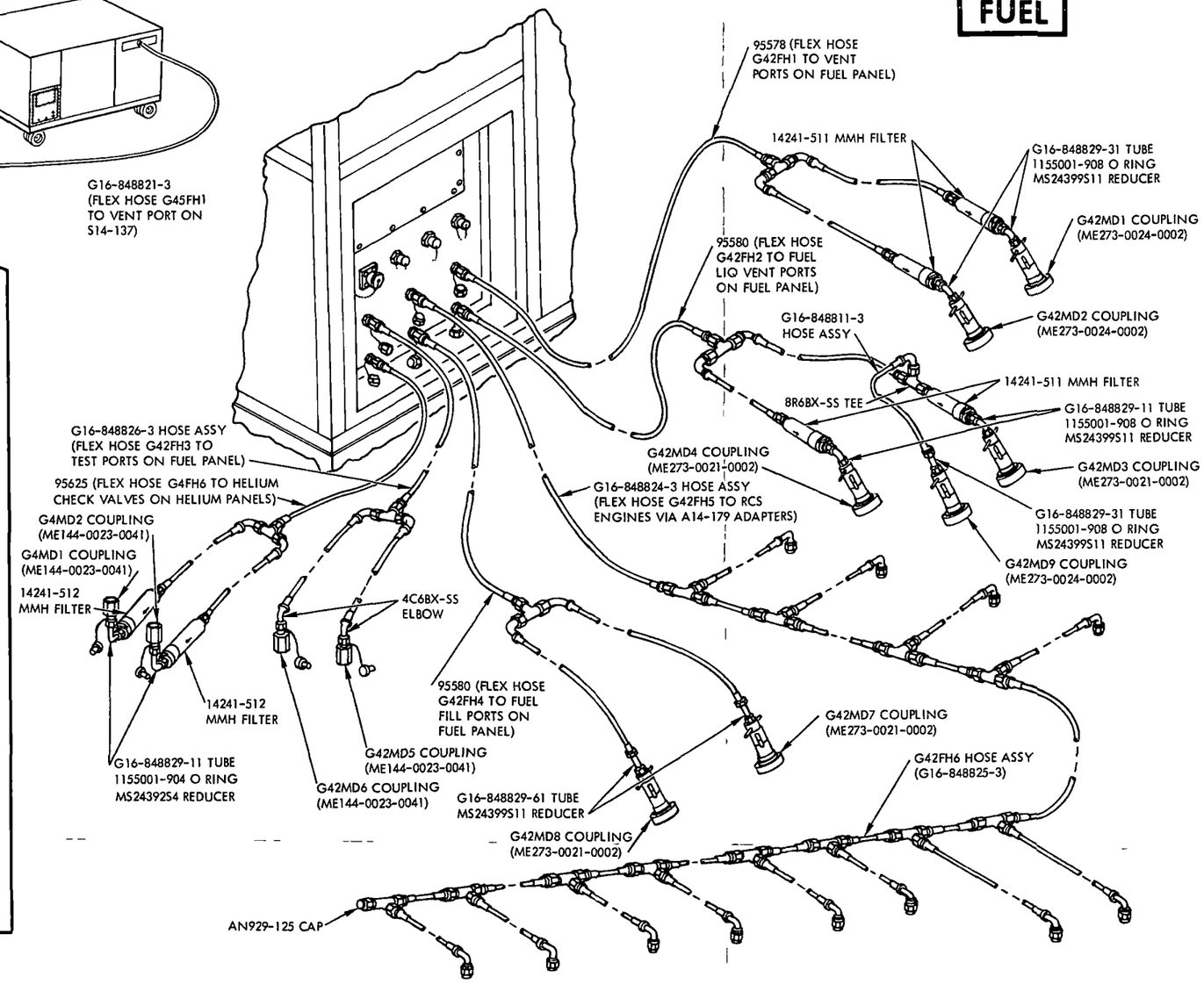

95578 (FLEX HOSE G42FH1 TO VENT PORTS ON FUEL PANEL)
14241-511 MMH FILTER
G16-848829-31 TUBE 1155001-908 O RING MS24399S11 REDUCER
G42MD1 COUPLING (ME273-0024-0002)
95580 (FLEX HOSE G42FH2 TO FUEL LIQ VENT PORTS ON FUEL PANEL)
G42MD2 COUPLING (ME273-0024-0002)
G16-848811-3 HOSE ASSY
14241-511 MMH FILTER
8R6BX-SS TEE
G16-848829-11 TUBE 1155001-908 O RING MS24399S11 REDUCER
G42MD4 COUPLING (ME273-0021-0002)
G42MD3 COUPLING (ME273-0021-0002)
G16-848826-3 HOSE ASSY (FLEX HOSE G42FH3 TO TEST PORTS ON FUEL PANEL)
95625 (FLEX HOSE G4FH6 TO HELIUM CHECK VALVES ON HELIUM PANELS)
G16-848824-3 HOSE ASSY (FLEX HOSE G42FH5 TO RCS ENGINES VIA A14-179 ADAPTERS)
G16-848829-31 TUBE 1155001-908 O RING MS24399S11 REDUCER
G4MD2 COUPLING (ME144-0023-0041)
G42MD9 COUPLING (ME273-0024-0002)
G4MD1 COUPLING (ME144-0023-0041)
14241-512 MMH FILTER
4C6BX-SS ELBOW
14241-512 MMH FILTER
95580 (FLEX HOSE G42FH4 TO FUEL FILL PORTS ON FUEL PANEL)
G42MD7 COUPLING (ME273-0021-0002)
G42MD5 COUPLING (ME144-0023-0041)
G42FH6 HOSE ASSY (G16-848825-3)
G16-848829-11 TUBE 1155001-904 O RING MS24392S4 REDUCER
G42MD6 COUPLING (ME144-0023-0041)
G16-848829-61 TUBE MS24399S11 REDUCER
G42MD8 COUPLING (ME273-0021-0002)
AN929-125 CAP
SM-2A-1169D

Figure 2-16 S14-137 Systems A and B Fluid Lines—Fuel

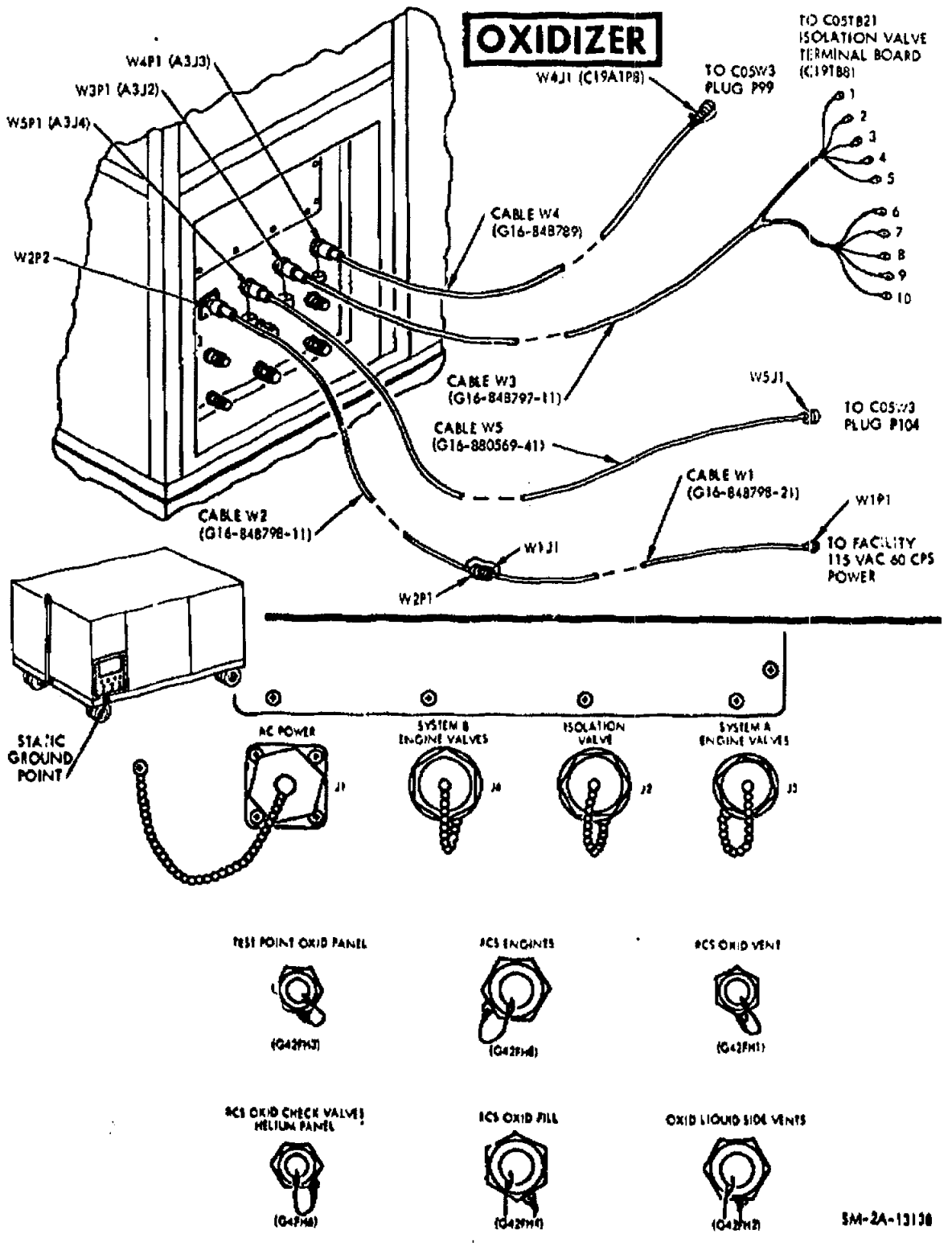


Figure 2-17. S14-138 Systems A and B Electrical Cables - Oxidizer (Sheet 1 of 2)

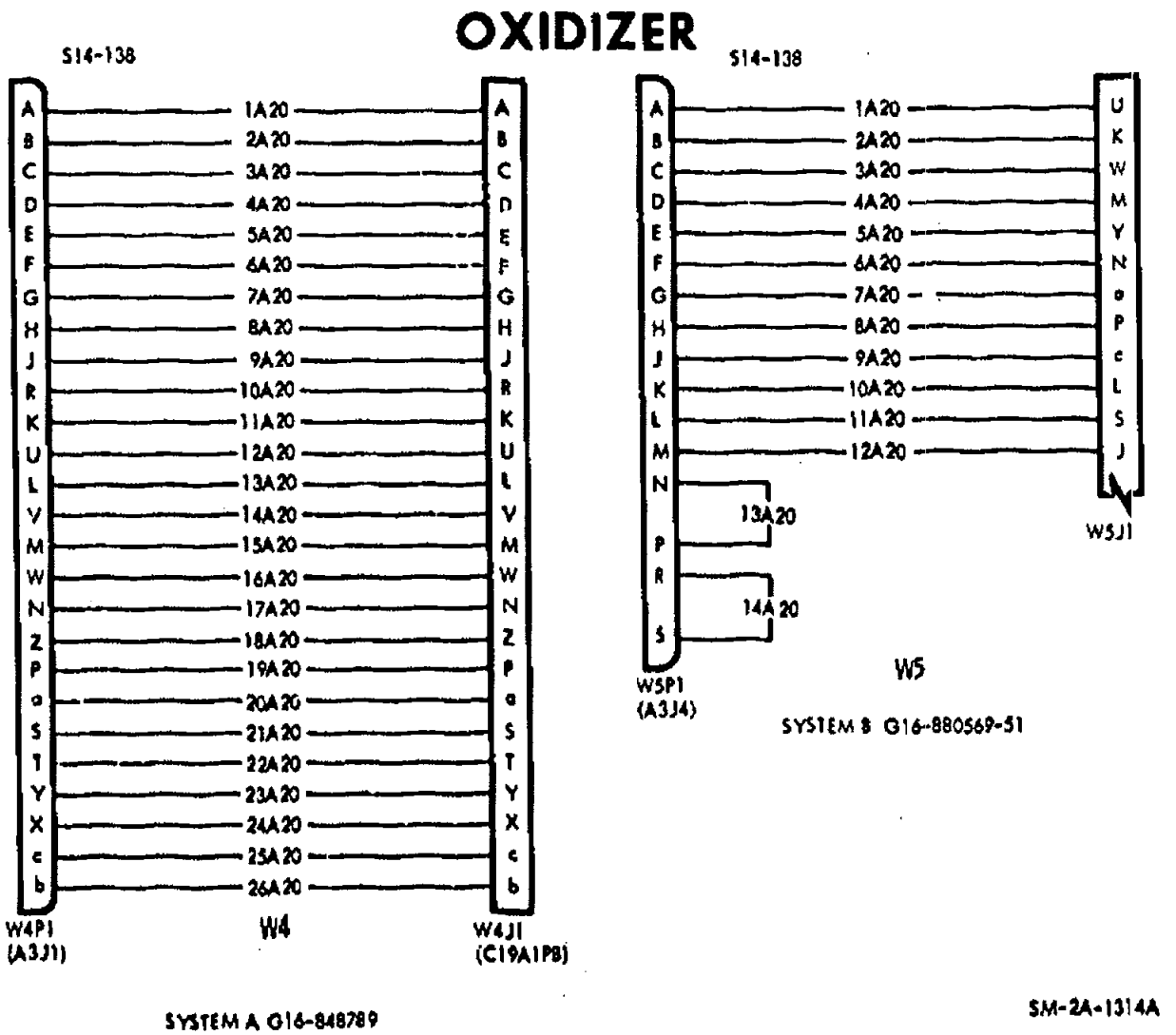
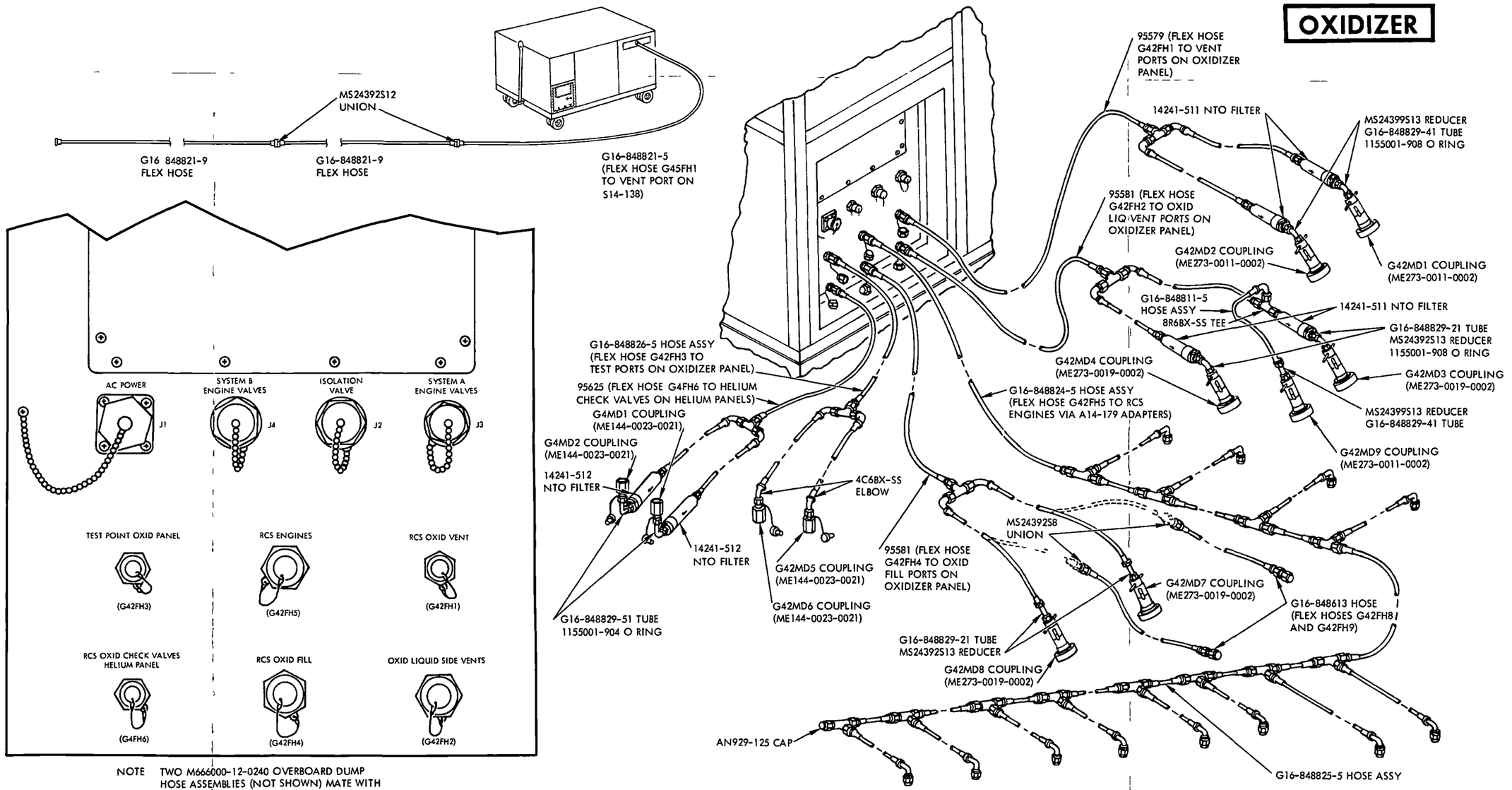


Figure 2-17. S14-138 Systems A and B Electrical Cables - Oxidizer (Sheet 2 of 2)



NOTE TWO M666000-12-0240 OVERBOARD DUMP HOSE ASSEMBLIES (NOT SHOWN) MATE WITH G42FH8 AND G42FH9 HOSE ASSEMBLIES

Figure 2-18 S14-138 Systems A and B Fluid Lines—Oxidizer

SECTION III

CM EVALUATION

3-1. GENERAL

3-2. The evaluation and electrical system preparation procedures provided within this section shall be completed prior to fuel or oxidizer system deactivation. Accomplishment of these procedures will prepare the CM for deactivation, as well as identify any unsafe conditions. In the event of an emergency or abnormal situation, the NASA LST Director shall be responsible for improvising repairs or action, as necessary, to ready the CM for deactivation. Figures 3-1 and 3-2 illustrate RCS engine and major component location.

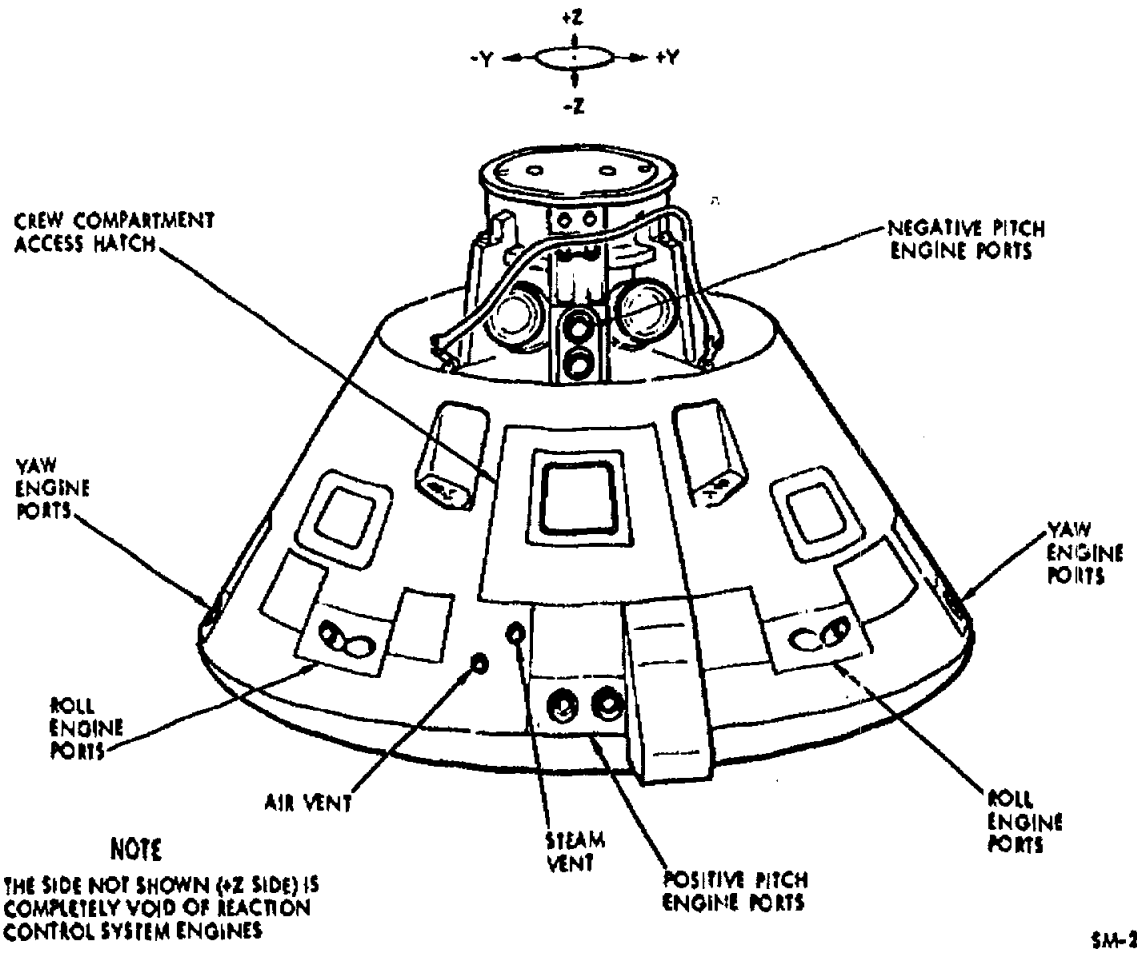


Figure 3-1. CM RCS Engine Locations

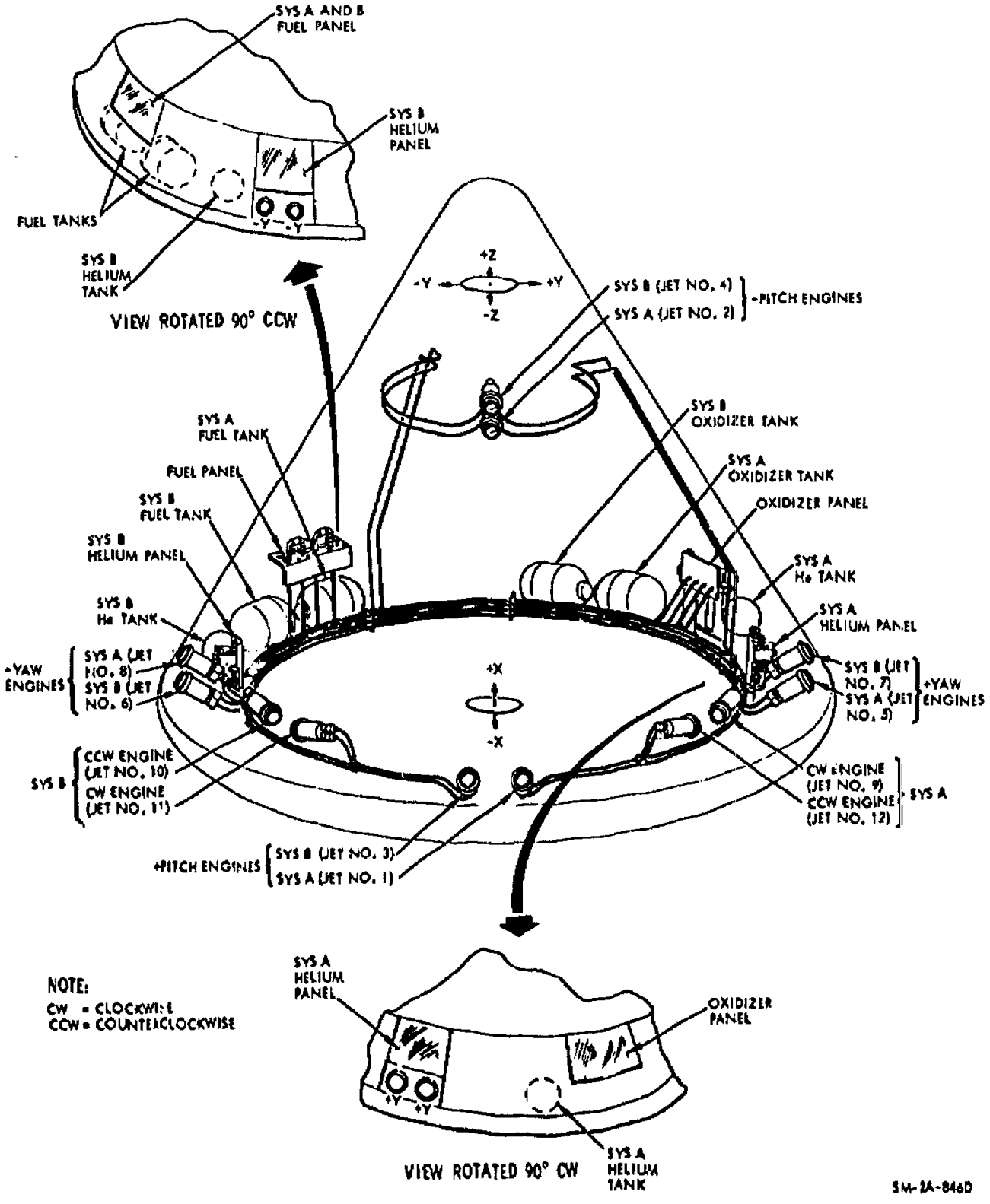


Figure 3-2. CM RCS Major Component Locations

3-3. CM ARRIVAL AND POSITIONING

3-4. Upon receipt of the CM, and prior to commencement of evaluation operations, accomplish the following:

a. Interrogate personnel responsible for shipboard postretrieval operations. Ascertain overall condition of CM and identify possible unsafe conditions.

b. Review shipboard postretrieval remarks.

c. Verify availability of protective clothing.

d. Verify availability of tools and equipment.

e. Position CM between deactivation units. (See figure 2-1)

NOTE

If an overhead crane is not available within the deactivation area, remove CM tie-down ring prior to positioning. (Refer to paragraph 3-18.)

3-5. INSPECTION AND EVALUATION

3-6. CM evaluation and safing operations shall be conducted in the following sequence:

WARNING

- Use caution when working in danger areas. All pyrotechnic devices/RCS engines shall be considered unsafe until verified otherwise.
- Monitor work areas for evidence of propellant vapors.
- Should propellant vapors be detected, flush area with large amounts of water (low pressure - fresh or salt), as necessary, to establish a safe condition.

NOTE

Obtain photographic coverage of evaluation and safing operations as directed by the NASA LST Director.

a. Accomplish system shutdown per paragraph 3-12.

b. Inspect forward compartment pyrotechnic devices, safe as necessary. (Refer to paragraph 3-20.)

WARNING

Pyrotechnic inspection and safing shall be accomplished by certified ordnance personnel.

c. Inspect CM exterior surface areas. Utilizing Postretrieval Procedures Manual (SM2A-08-SC017) as a guide, record any damage which may have been incurred during off-loading. (Refer to paragraph 3-14.)

d. Remove RCS access panels and inspect components for damage, leaks, etc. (Refer to paragraph 3-57.)

e. Deactivate pyrotechnic devices associated with the RCS. (Refer to paragraph 3-20.)

f. Prepare CM electrical connectors and terminal boards for interface with deactivation units. (Refer to paragraph 3-66.)

3-7. HATCH REMOVAL

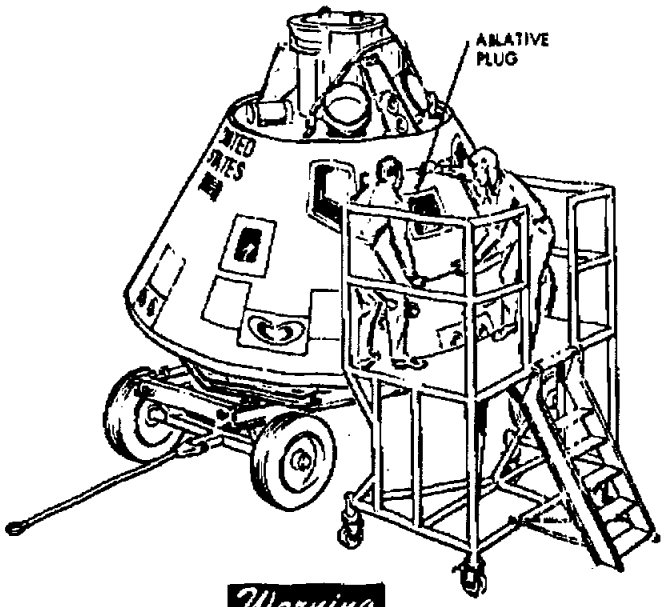
3-8. Should it become necessary for the LST to gain access to the interior of the CM, refer to paragraphs 3-7 through 3-10 (as applicable).

NOTE

CM hatches shall not be removed, unless so directed by the NASA LST Director

3-9. OUTER HATCH. The outer hatch may be unlatched by one of two methods; normal or emergency. (See figure 3-3.) Normal procedures for disengaging the latching mechanism and removing the outer hatch are as follows:

a. Remove "screw-in" ablative plug located immediately above the hatch window.

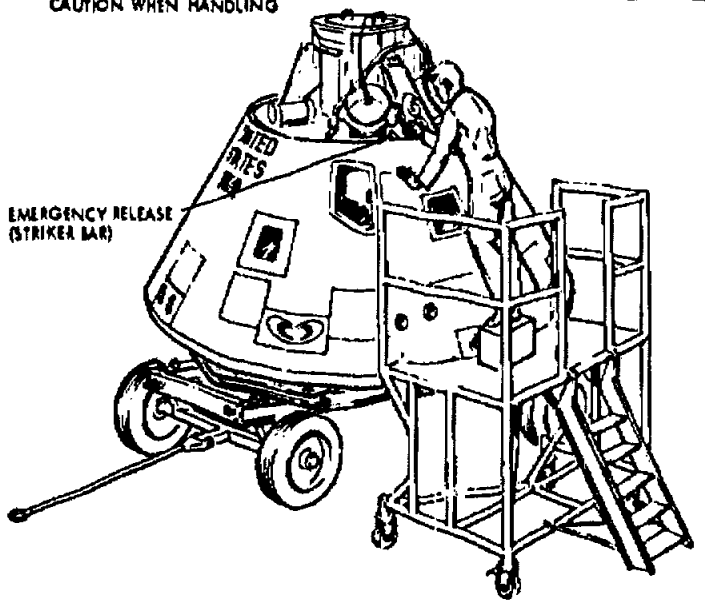


1. REMOVE "SCREW-IN" ABLATIVE PLUG.
2. INSERT COMBINATION TOOL OR 7/16 INCH DRIVE ADAPTER INTO LATCH AND ROTATE COUNTERCLOCKWISE.
3. USING UNLATCHING TOOL (AS A HANDLE) LIFT HATCH COVER FROM C/M.

Warning

THE OUTER HATCH COVER WEIGHS APPROXIMATELY 86 LBS, USE CAUTION WHEN HANDLING

NORMAL RELEASE



NOTE

HATCH SHALL NOT BE REMOVED UNLESS AUTHORIZED BY THE NASA LST LEADER

1. EXTEND STRIKER BAR
2. STRIKE EMERGENCY RELEASE WITH HAMMER
3. REMOVE HATCH

EMERGENCY RELEASE

SM-2A-1067C

Figure 3-3. CM Hatch Removal (Outer)

b. Insert NASA combination tool, or 7/16-inch drive adapter into latch drive shaft and rotate counterclockwise to release latching mechanism.

c. Using the unlatching tool as a handle, lift hatch up and out.

NOTE

Combination tool may be used as a pry bar, if necessary.

d. Stow hatch on padded surface to avoid damage.

3-10. If an alternate mode of entry into the CM is desired, actuate the outer hatch emergency release mechanism (figure 3-3) as follows:

a. Extend striker bar by turning 50 turns (counterclockwise) or until bar has extended approximately 2 inches.

b. Using a hammer, strike striker-bar sharply to actuate latching mechanism.

c. Using unlatching tool as a handle, lift hatch up and out.

d. Stow hatch on padded surface to avoid damage.

3-11. INNER HATCH. External release of the inner hatch (figure 3-4) latching mechanism may be accomplished as follows:

NOTE

Prior to releasing the latching mechanism, disengage handhold locks, rotate handholds outboard (to facilitate handling) and re-engage the handhold locks.

a. Using a 7/16-inch socket wrench, engage the drive shaft stud, rotate in a clockwise direction to disengage latching mechanism.

b. Grasp handles (handholds) and remove hatch.

c. Stow hatch within CM.

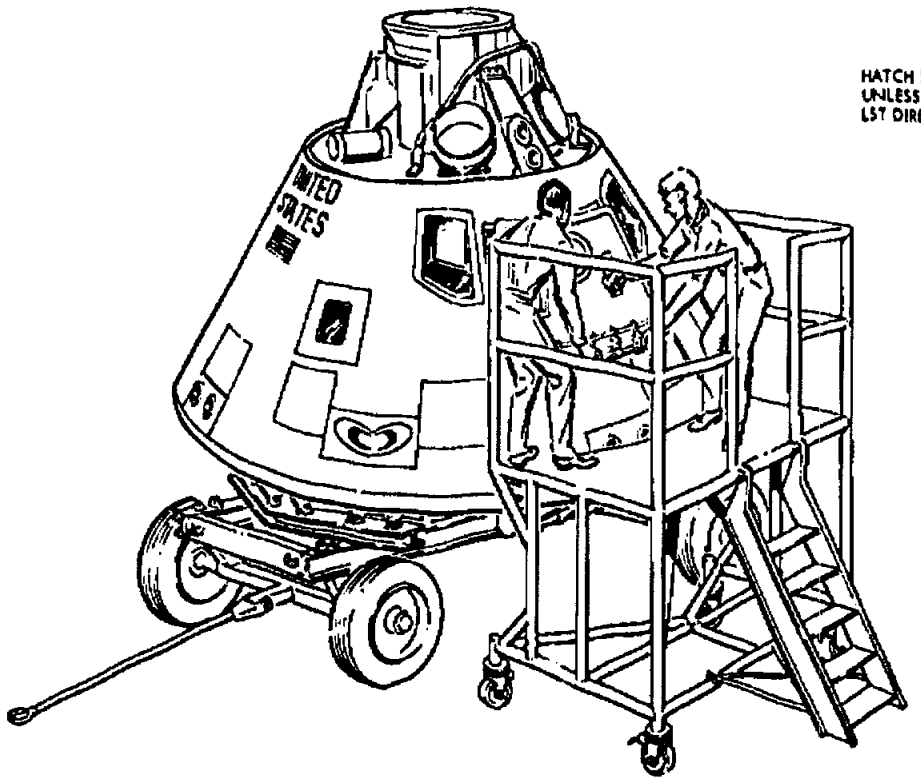

NOTE
HATCH SHALL NOT BE REMOVED UNLESS AUTHORIZED BY NASA LST DIRECTOR
UNITED STATES
1 DISENGAGE HANDHOLD LOCK PINS AND ROTATE HANDHOLDS OUTBOARD, REINSTALL LOCK PINS.
2 USING A 7/16-INCH SOCKET WRENCH ENGAGE DRIVE SHAFT STUD AND ROTATE IN A CLOCKWISE DIRECTION TO DISENGAGE LATCHING MECHANISM.
3 GRASP HANDHOLDS AND LIFT COVER FROM C/M.
HANDHOLD LOCK PINS (T-LOCKS)
HANDHOLDS (ROTATED OUTBOARD)
SEALED DRIVE SHAFT (BOTH SIDES)
SM-2A-106C

Figure 3-4. CM Hatch Removal (Inner)

3-12. SYSTEM SHUTDOWN

3-13. Prior to commencement of any safing or deactivation operations, verify circuit breakers (figure 3-5) are pulled.

NOTE

- Ascertain position of circuit breakers (completed aboard the recovery vessel) by reviewing the Postretrieval Procedures Manual (SM2A-08-SC017). If circuit breakers are not positioned in accordance with the desires of the NASA LST Director, remove outer and inner hatch (paragraphs 3-9 and 3-11) to gain access to the various circuit breaker panels.

- On panel 25 of MDC (CB 46), STABILIZATION & CONTROL SYSTEM-GROUP 1-AC1 circuit breaker is slugged (shorted).

- On auxiliary power control box at lower equipment bay (CB8), AUX BAT 1-POST LDG MCP circuit breaker is slugged (shorted).

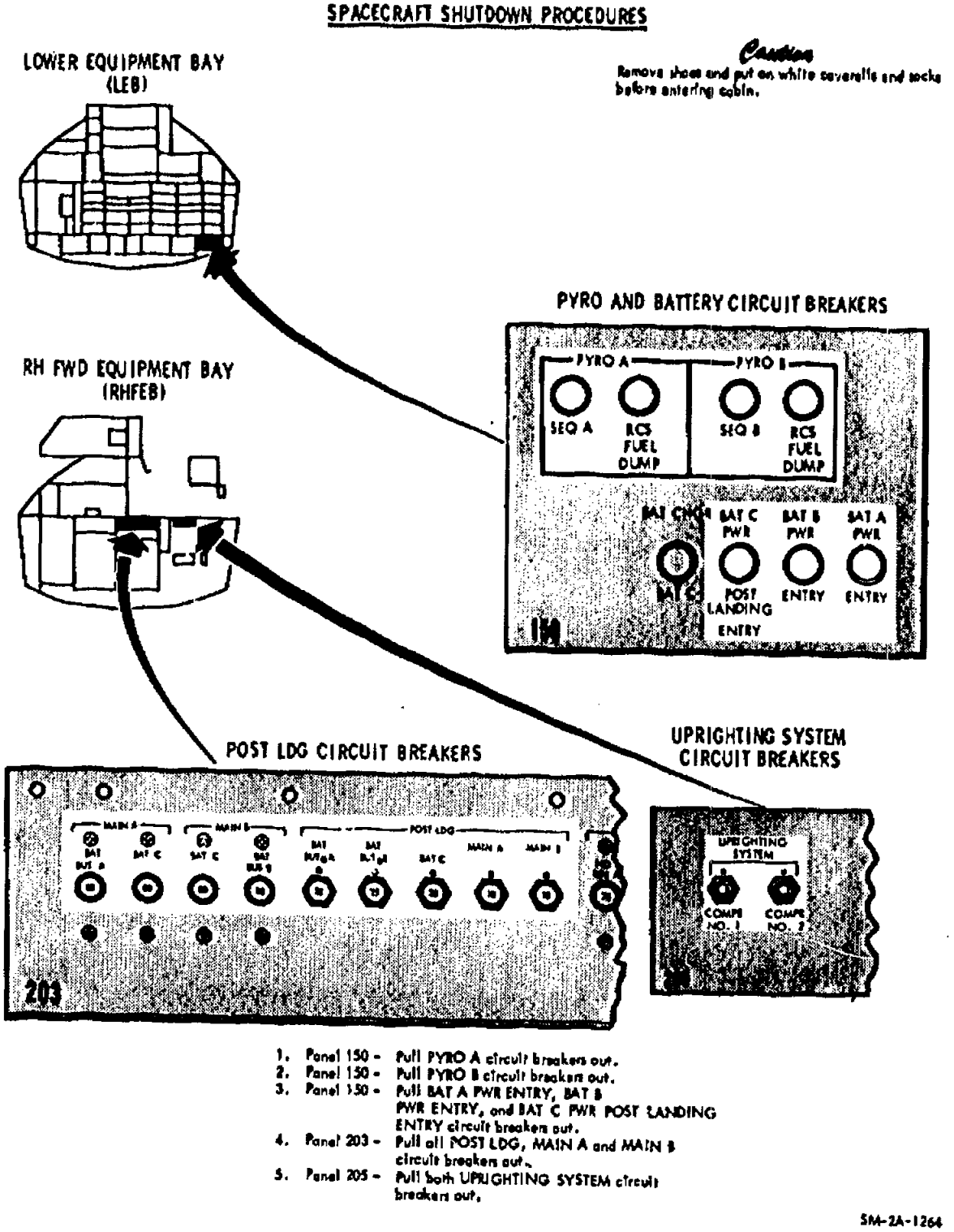
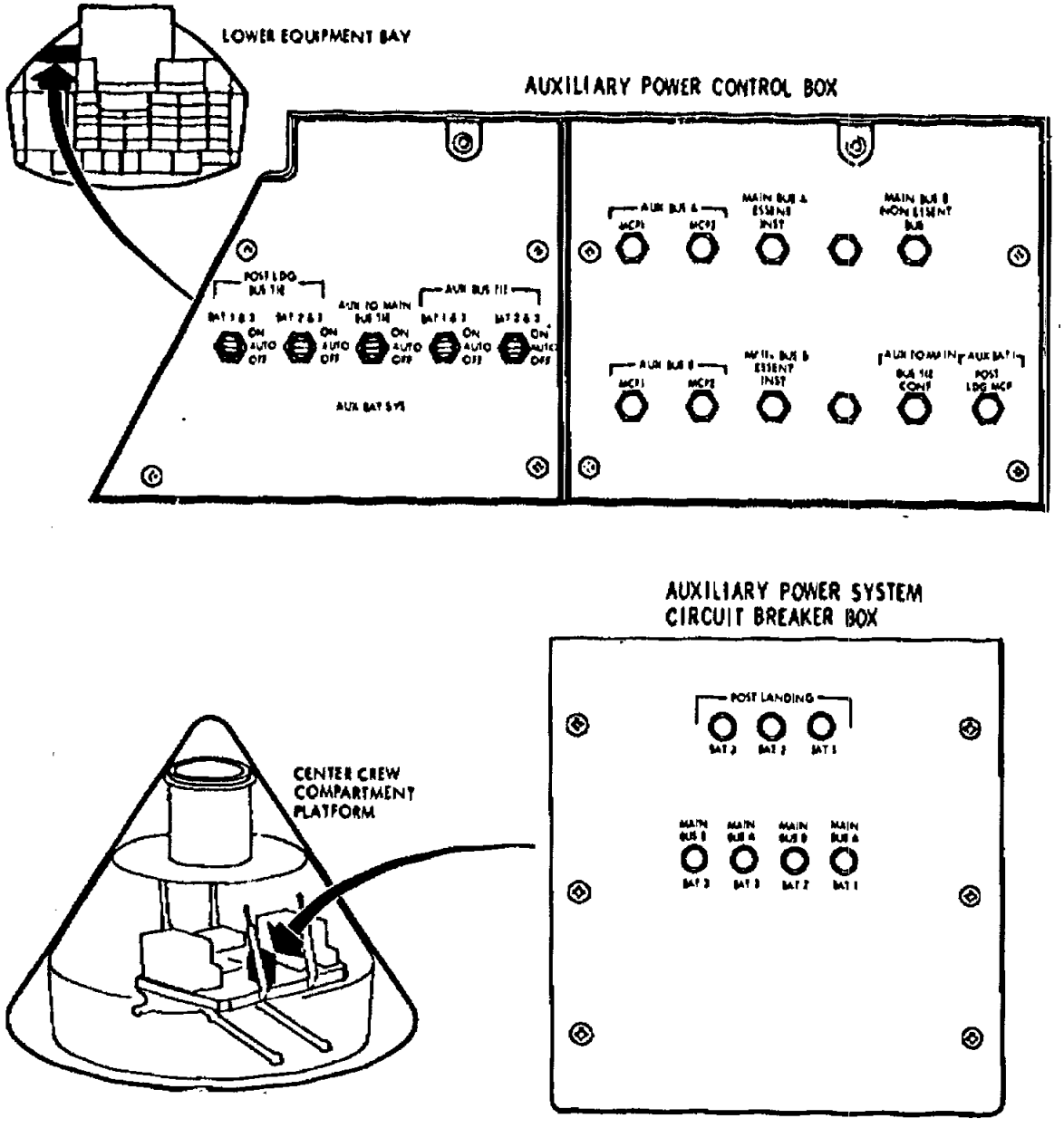

SPACECRAFT SHUTDOWN PROCEDURES
LOWER EQUIPMENT BAY (LEB)
Caution
Remove shoes and put on white coveralls and socks before entering cabin.
PYRO AND BATTERY CIRCUIT BREAKERS
PYRO A
PYRO B
SEQ A
RCS FUEL DUMP
SEQ B
RCS FUEL DUMP
BAT CHGR
BAT C PWR
BAT B PWR
BAT A PWR
POST LANDING ENTRY
ENTRY
ENTRY
RH FWD EQUIPMENT BAY (RHFEB)
POST LDG CIRCUIT BREAKERS
UPRIGHTING SYSTEM CIRCUIT BREAKERS
MAIN A
MAIN B
POST LDG
UPRIGHTING SYSTEM
COMPR NO. 1
COMPR NO. 2
203
1. Panel 150 - Pull PYRO A circuit breakers out.
2. Panel 150 - Pull PYRO B circuit breakers out.
3. Panel 150 - Pull BAT A PWR ENTRY, BAT B PWR ENTRY, and BAT C PWR POST LANDING ENTRY circuit breakers out.
4. Panel 203 - Pull all POST LDG, MAIN A and MAIN B circuit breakers out.
5. Panel 205 - Pull both UPRIGHTING SYSTEM circuit breakers out.
SM-2A-1264

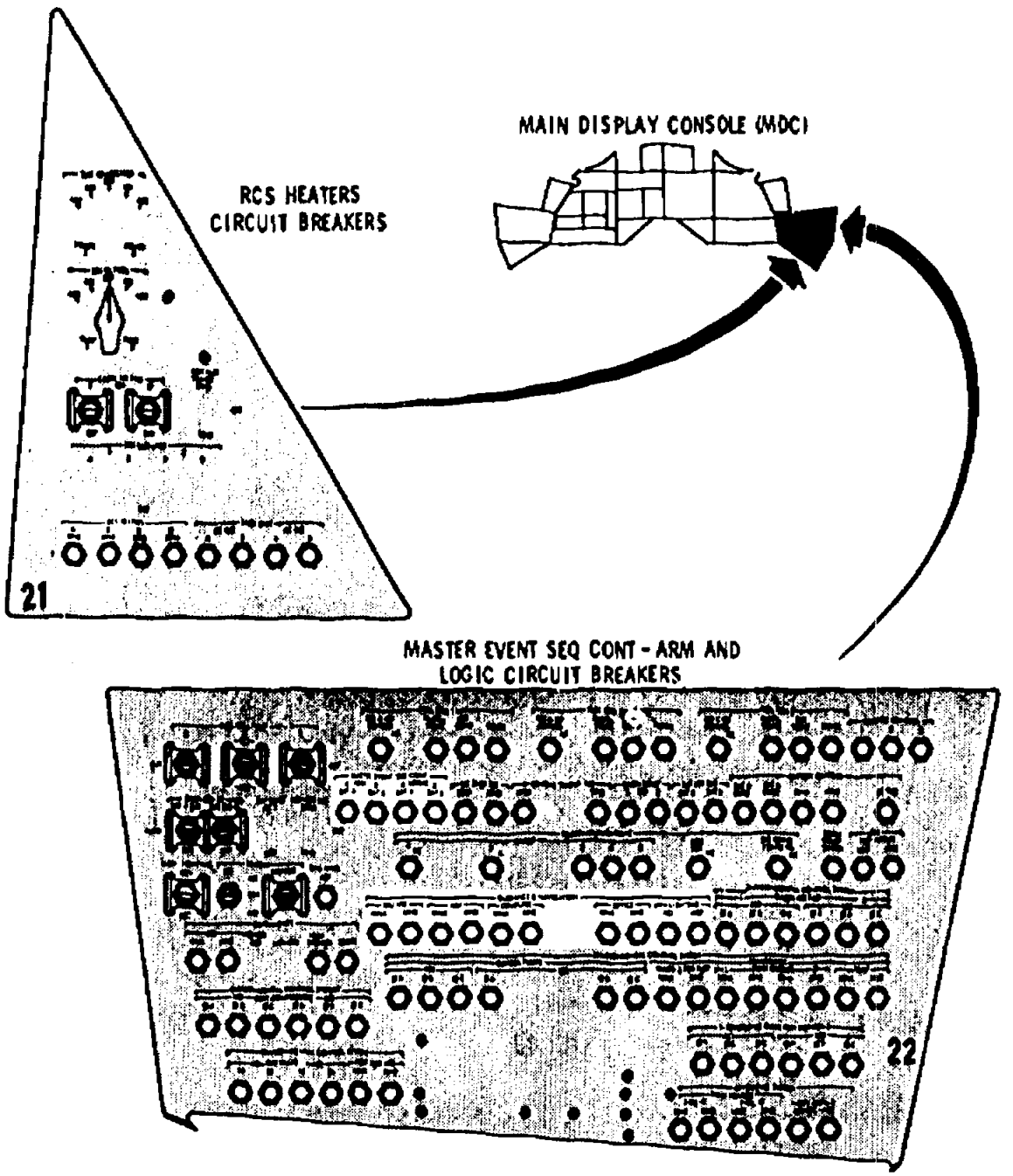
Figure 3-5. CM Systems Shutdown (Sheet 1 of 5)



6. Auxiliary Power Control Box - Place all AUX BAT SYS switches to OFF.
7. Auxiliary Power Control Box - Pull all circuit breakers out.
8. Auxiliary Power System Circuit Breaker Box - Pull all circuit breakers out.

SM-2A-1265A

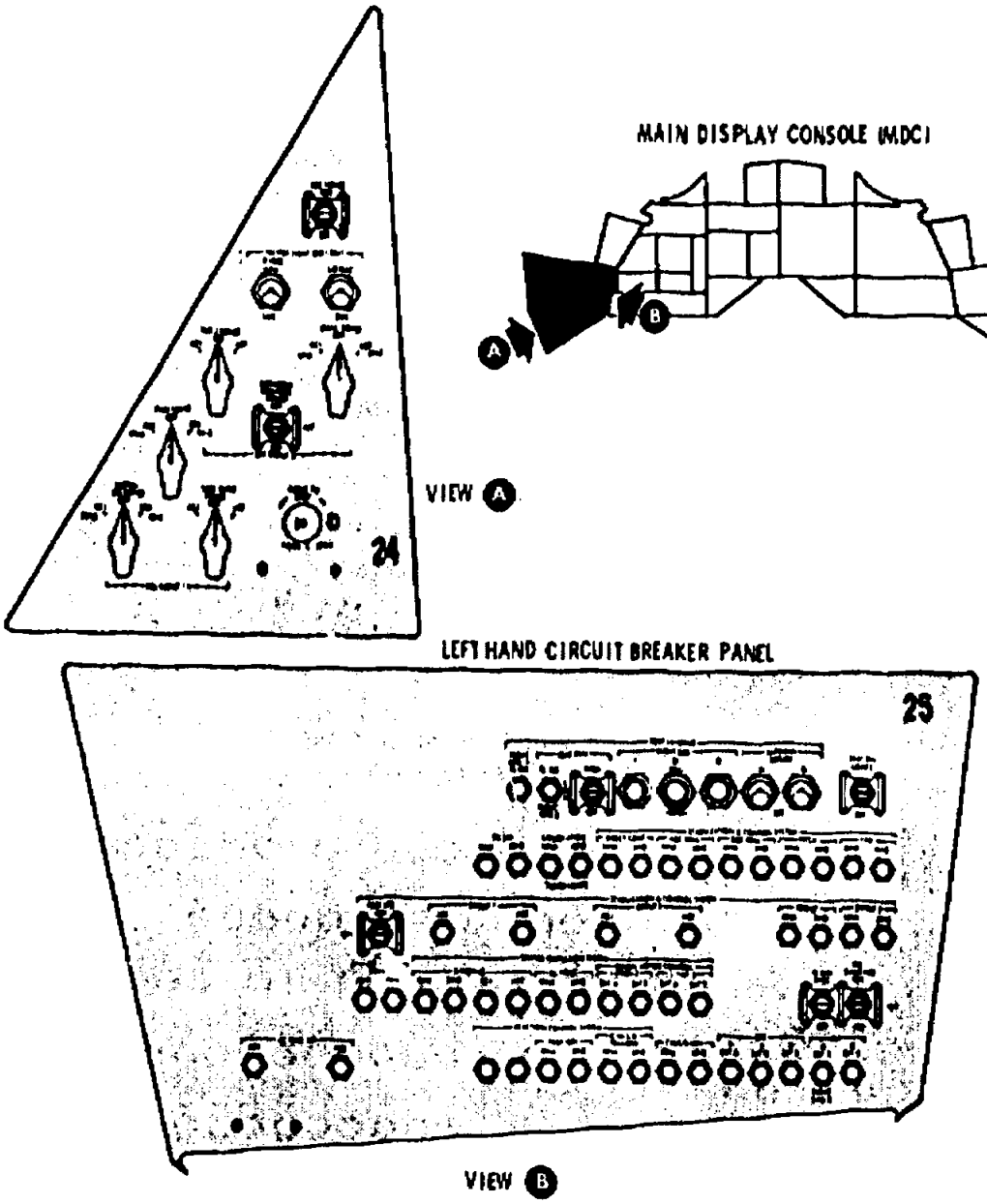
Figure 3-5. CM Systems Shutdown (Sheet 2 of 5)



9. Panel 21 - Pull RCS HEATERS - A MNB, and - B MNA circuit breakers out.
10. Panel 22 - Pull MASTER EVENT SEQ CONT - ARM circuit breakers out.
11. Panel 22 - Pull MASTER EVENT SEQ CONT - LOGIC circuit breakers out.
12. Panel 22 - Pull all GUIDANCE & NAVIGATION circuit breakers out.

SM-2A-1266

Figure 3-5. CM Systems Shutdown (Sheet 3 of 5)



13. Panel 24 - Place MASTER EVENT SEQ CONT - PYRO ARM switch to SAFE
14. Panel 24 - Place MASTER EVENT SEQ CONT - LOGIC switch to OFF.
15. Panel 25 - Place BEACON LIGHTS switch to OFF
16. Panel 25 - Pull REACTION CONTROL SYSTEM - PROP ISOL and C/M-S/M TRANSFER circuit breakers out.
17. Panel 25 - Pull STABILIZATION & CONTROL SYSTEM circuit breakers out.

SM-2A-12678

Figure 3-5. CM Systems Shutdown (Sheet 4 of 5)

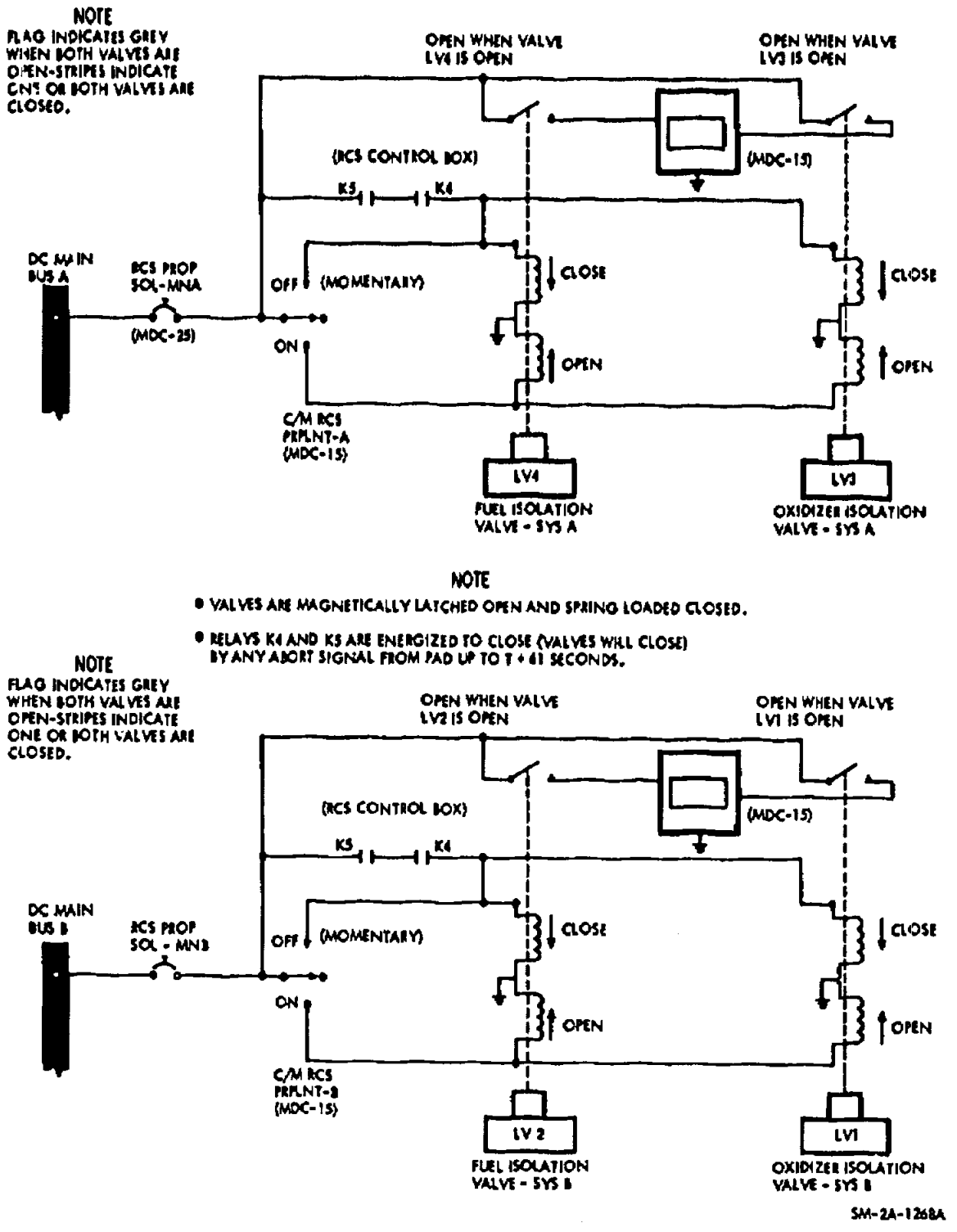


Figure 3-5. CM Systems Shutdown (Sheet 5 of 5)

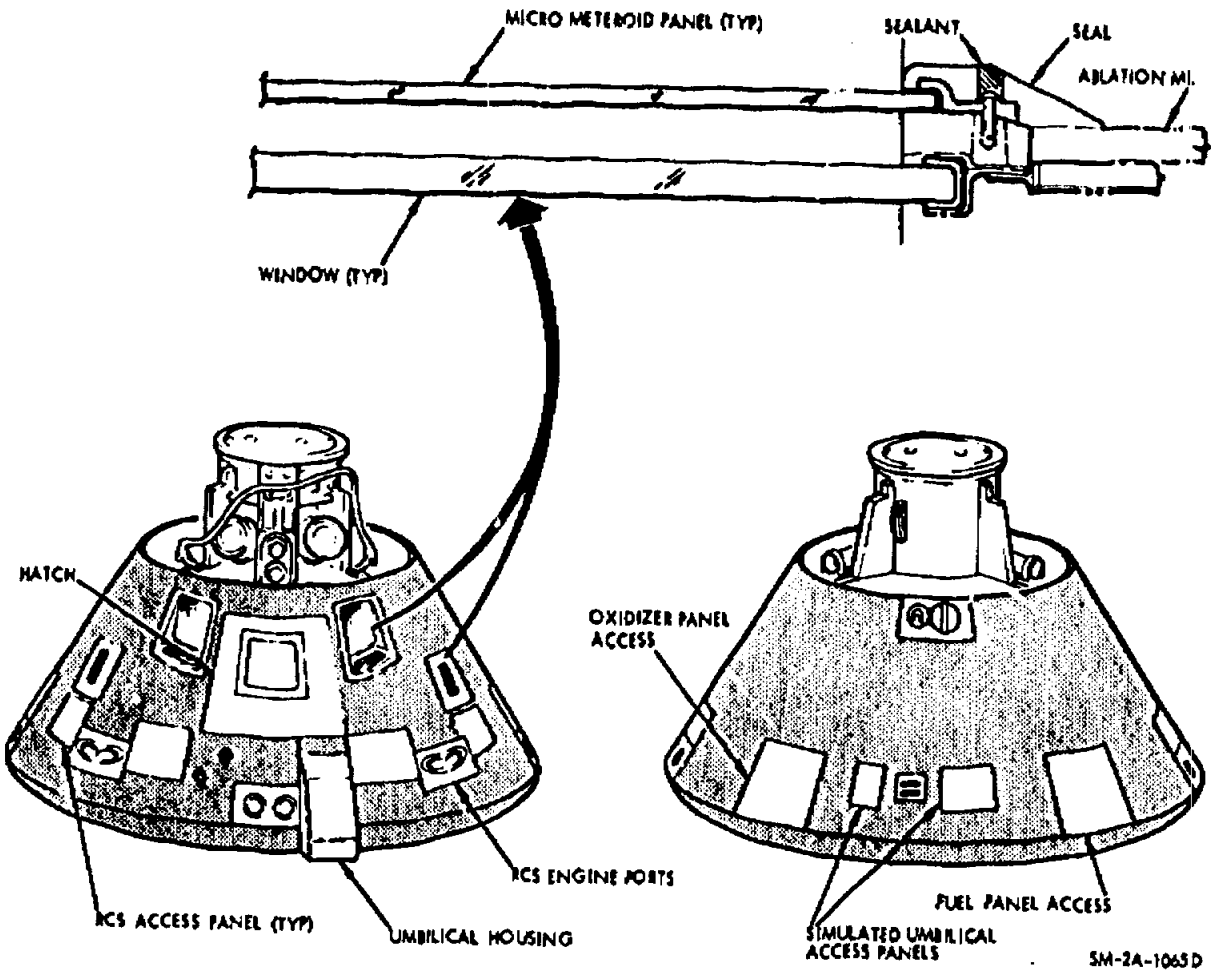


Figure 3-6. CM Inspection (Exterior)

3-14. CM INSPECTION (EXTERIOR)

3-15. A detailed inspection (figure 3-6) of the CM exterior surfaces will normally be conducted on-board the recovery vessel per Postretrieval Procedures Manual (SM2A-08-SC017). Accordingly, exterior inspection by the LST will be limited to that required to identify dangerous situations (propellant leaks, jagged edges, etc.), as well as any damage which might have been incurred during transportation. Any damage noted during this inspection shall be recorded by the Team Leader.

3-16. PHOTOGRAPHIC REQUIREMENTS

3-17. A complete series of photographs, depicting the "as recovered" conditions of the CM exterior surface, will have been obtained on-board the recovery vessel. Accordingly, exterior surface photographs obtained by the LST will be confined to recording handling damage. Additional photographic coverage shall be at the discretion of the NASA LST Director.

3-18. TIE-DOWN RING REMOVAL

3-19. Removal of the CM tie-down ring (figure 3-7) is required to facilitate access to components mounted within the forward compartment. Time and place of removal is dependent upon deactivation site capabilities. If the deactivation site does not contain an overhead crane, remove tie-down ring prior to positioning CM for deactivation; utilize a mobile crane. If an overhead crane is available, position the CM between the deactivation units (figure 3-1) and proceed as follows:

a. Remove and stow nylon tie-down straps.

b. Attach bridle to tie-down ring.

c. Using overhead (or mobile) crane, remove tie-down ring.

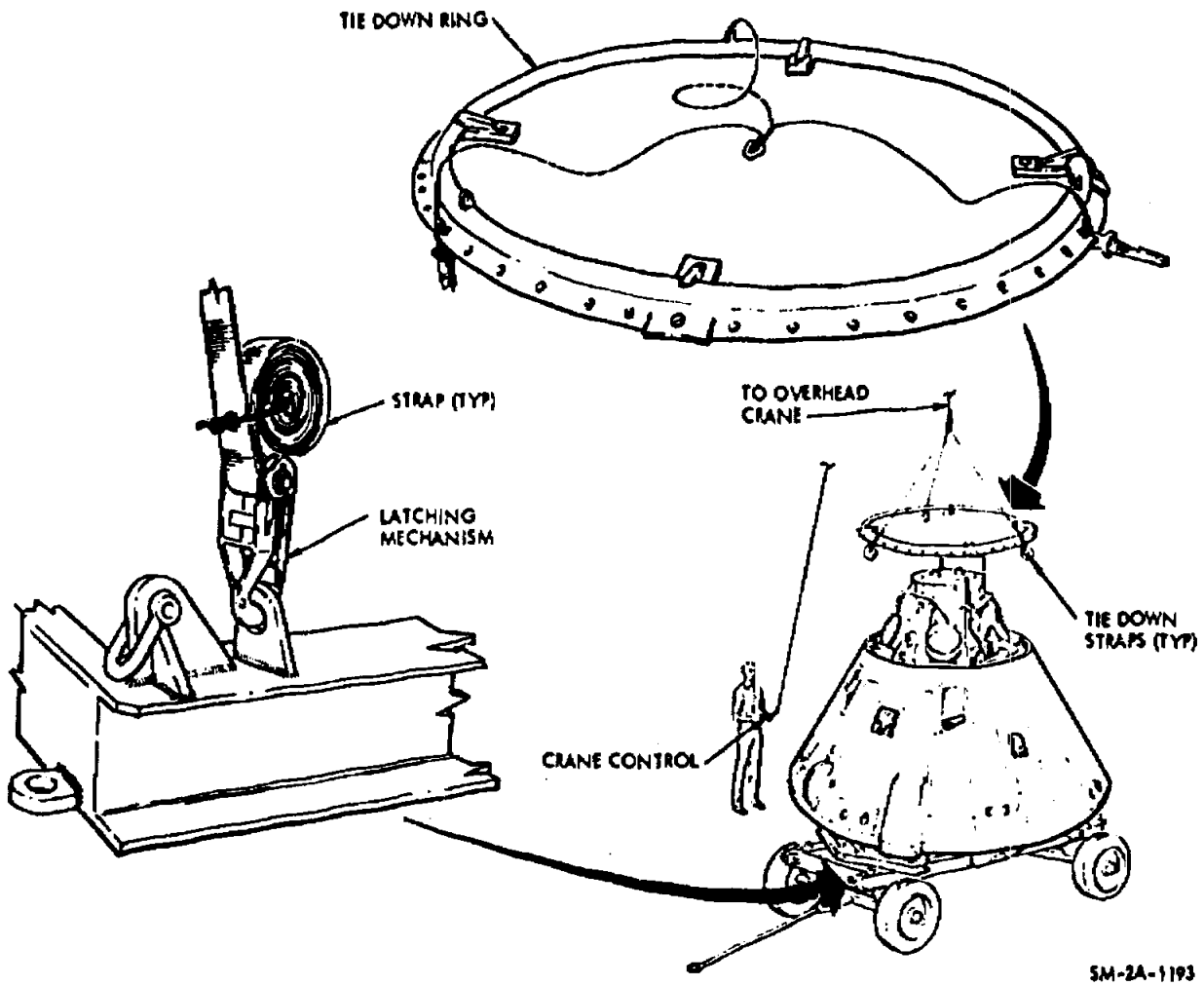


Figure 3-7. Tie-Down Ring Removal

3-20. PYROTECHNIC SAFING

3-21. To safe the explosive devices of the Apollo CM, positive identification and location of each device is required. In as much as various explosive devices are utilized, which, if unfired or only partially fired, could present a safety hazard, the following brief descriptive paragraphs are considered necessary.

3-22. REEFING LINE CUTTER. Thirty-two reefing line cutters are used with the drogue parachutes (8), main parachutes (18), recovery beacon (2), and VHF antennas (4). The reefing line cutter (figure 3-8) is a small device similar in working principle to a hand grenade. When the sear pin is pulled, releasing the firing pin, an 8-second fuze is ignited. After the fuze has burned, it explodes a small charge which drives a cutting blade against an anvil and severs the reefing line (parachutes) or nomex cord (antenna and recovery beacon). An unfired reefing line cutter is not considered a safety hazard.

3-23. HOTWIRE INITIATOR. The dual bridgewire initiator, Apollo standard initiator (ASI), or the single bridgewire initiator, Apollo standard initiator (SBASI) is a hotwire initiator used to initiate all electrically sequenced Apollo spacecraft ordnance devices and subsystems. The initiator acts as the primer, in most applications, for the main explosive charge. Initiators are used as a sole source of explosives on squib valves and the HF antenna deploy mechanism. The hotwire initiator (ASI), shown in figure 3-9, has two pairs of pins, each electrically connected with a 1-ohm resistance wire. When a current of 5 amperes or 29±2 volts dc is applied, the 1-ohm resistive wire ignites the primary explosive which in turn sets off the secondary explosive and fires the pyrotechnic device.

It is standard Apollo practice to use only one pair of these pins. Two initiators, where design permits, are used for each pyrotechnic application to provide redundancy. The hotwire initiator (SBASI) is presently in the proposal stage, and if acceptable, will be used in some applications. The SBASI initiator has only one pair of pins.

3-24. DETONATOR CARTRIDGE. The detonator cartridge, (figure 3-9) is made up of a hotwire initiator and an additional explosive charge usually composed of lead oxide and RDX. Detonator cartridges are used to effect certain functions by themselves, as well as effect sympathetic detonation of another pyrotechnic device by concussion. One such device is the flexible linear-shaped charge (FLSC) assembled into cutting charges utilized in the drogue chute release assembly. The detonator cartridges are used by themselves in the main chute release assemblies.

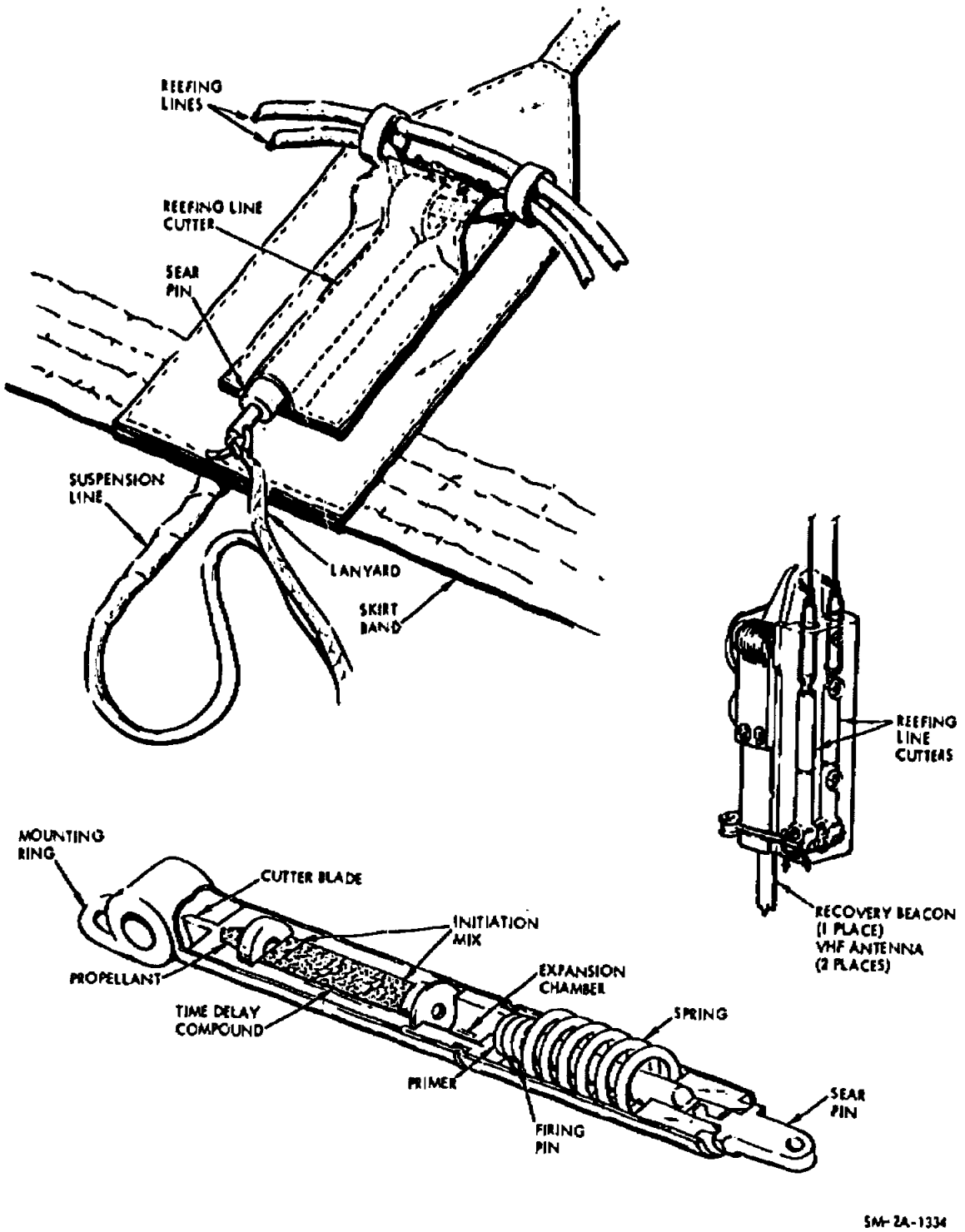
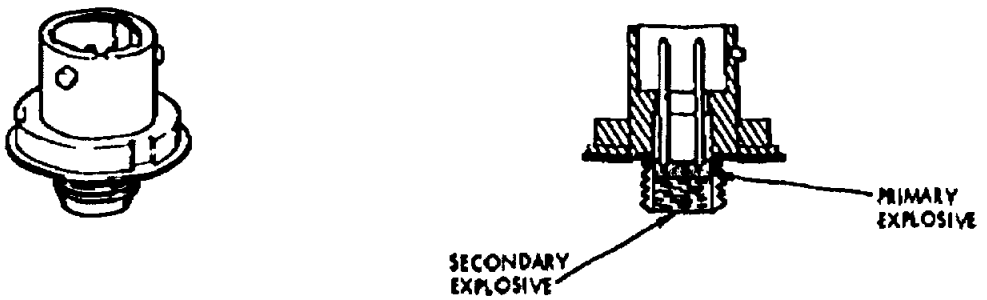
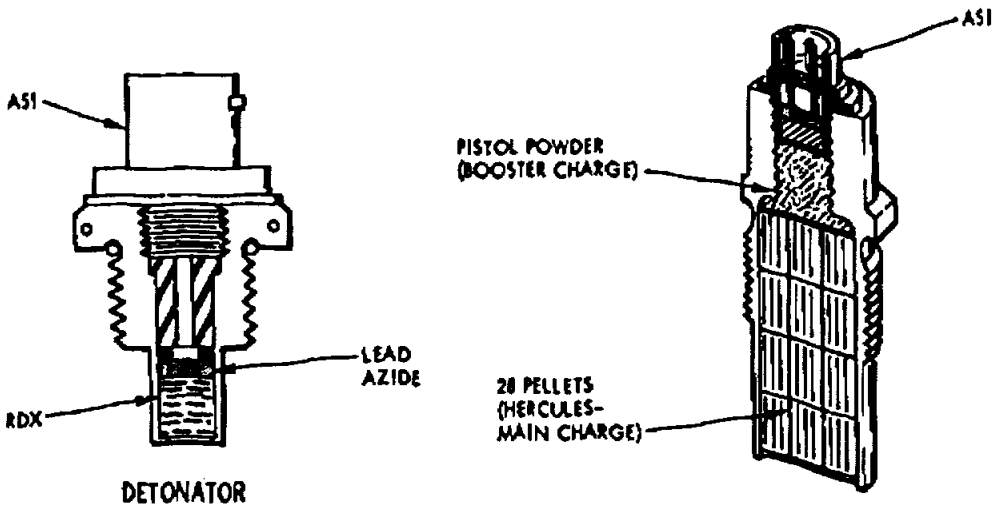


Figure 3-8. Reefing Line Cutter (ME901-0001-0024)



APOLLO STANDARD INITIATOR (ASI)



SM-2A-1335A

Figure 3-9. Hotwire Initiators, Detonator Cartridges, and Gas Pressure Cartridges

3-25. GAS PRESSURE CARTRIDGE. The gas pressure cartridge or gas generator, as it is often called, is the electrically initiated hotwire type. (See figure 3-9.) The ASI is used to initiate the burning of a booster charge of pistol powder, which in turn ignites the main charge of pellets. The fast burning of these pellets generates gas pressures to actuate the forward heat shield thrusters, the parachute deployment mortars, and the CM-SM deadface circuit interrupters.

3-26. PYROTECHNIC INSTALLATION

3-27. Three major areas of the CM utilize pyrotechnic devices: the forward compartment (top deck), crew compartment, and the aft compartment. Located on the top deck (figure 3-10) are the components of the forward heat shield jettison mechanism, parachute subsystem, and the HF antenna. The CM-SM deadface circuit interrupters are located in the crew compartment right-hand equipment bay (RHEB), shown in figure 3-11; and the reaction control system (RCS) components are in the aft compartment as shown in figure 3-12.

A total of 41 hotwire initiators remain with the CM after recovery. Because certain initiators are fired only in the event of a pad or low-altitude abort, and due to the redundant application of initiators, positive identification of fired devices can be established only by an individual test of each initiator using an igniter circuit tester.

3-28. FORWARD HEAT SHIELD JETTISON MECHANISM

3-29. The forward heat shield (FHS) is jettisoned to uncover the parachutes for subsequent deployment during the final descent phase of the mission. Two identical jettison systems are provided for redundancy, with either system being capable of jettisoning the FHS in case one system should fail. Each system is comprised of two diagonally opposed thrusters manifolded to a common breech assembly. One thruster of each system incorporates a pressure cartridge. (See figures 3-10 and 3-13.)

3-30. SAFING FORWARD HEAT SHIELD THRUSTERS. See figure 3-13, and safe the FHS thrusters as follows:

a. Refer to items 1 and 2 (paragraph 3-56) for identity of pressure cartridges and electrical connectors on FHS thrusters at longerons No. 3 and No. 4.

b. Verify condition of pressure cartridges by performing igniter circuit test in paragraph 3-54.

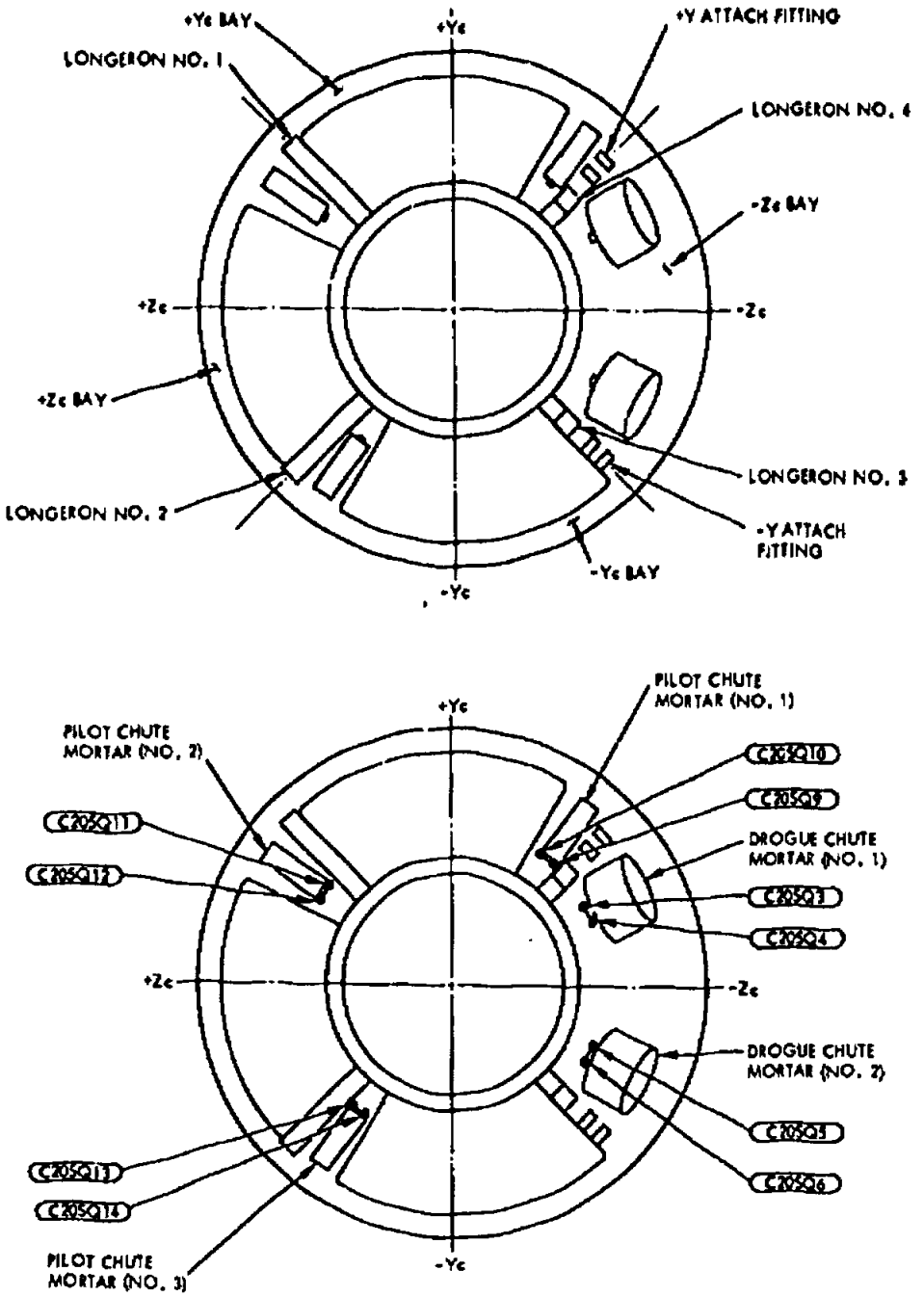


Figure 3-10. Forward Compartment Pyrotechnics (Sheet 1 of 2)

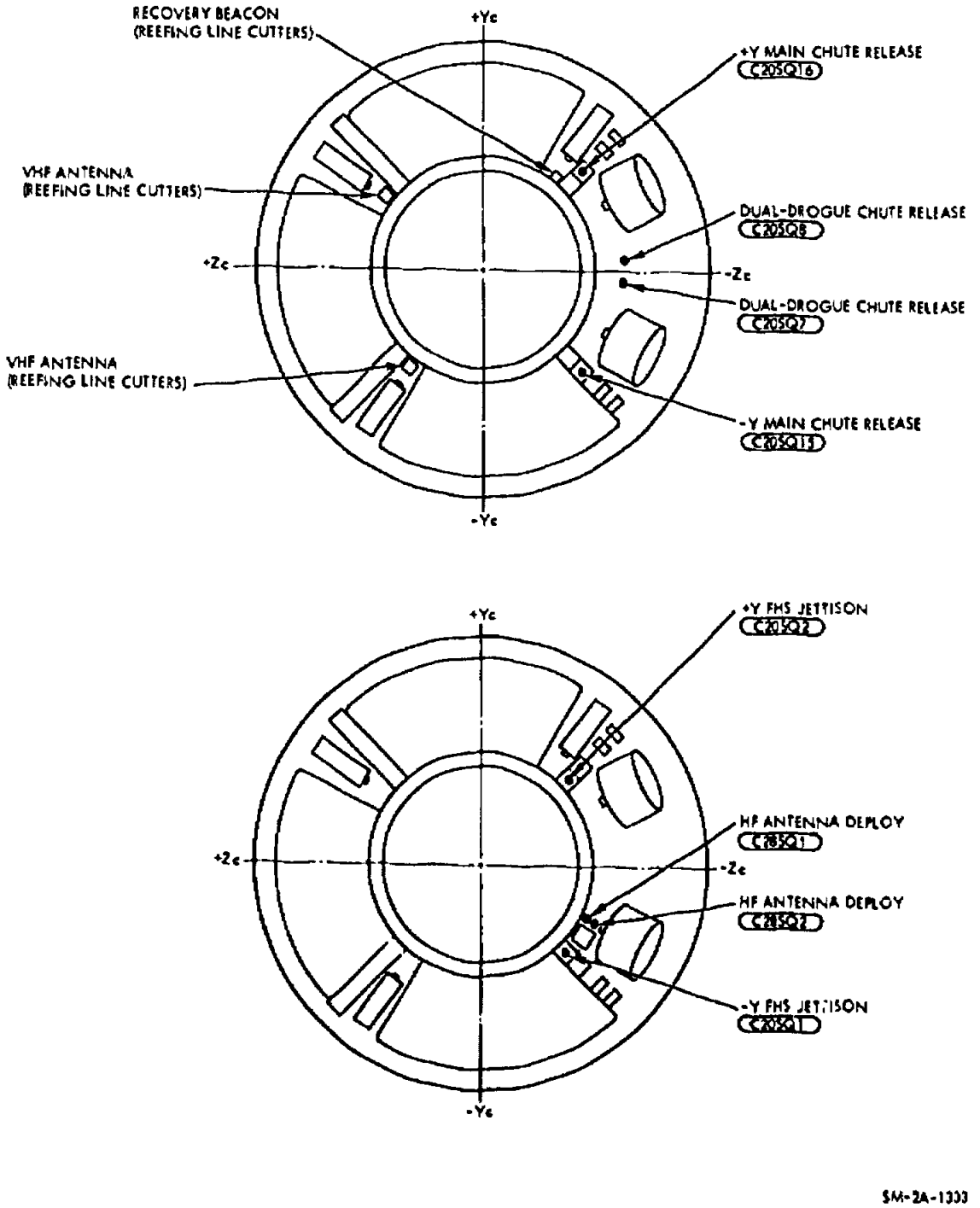
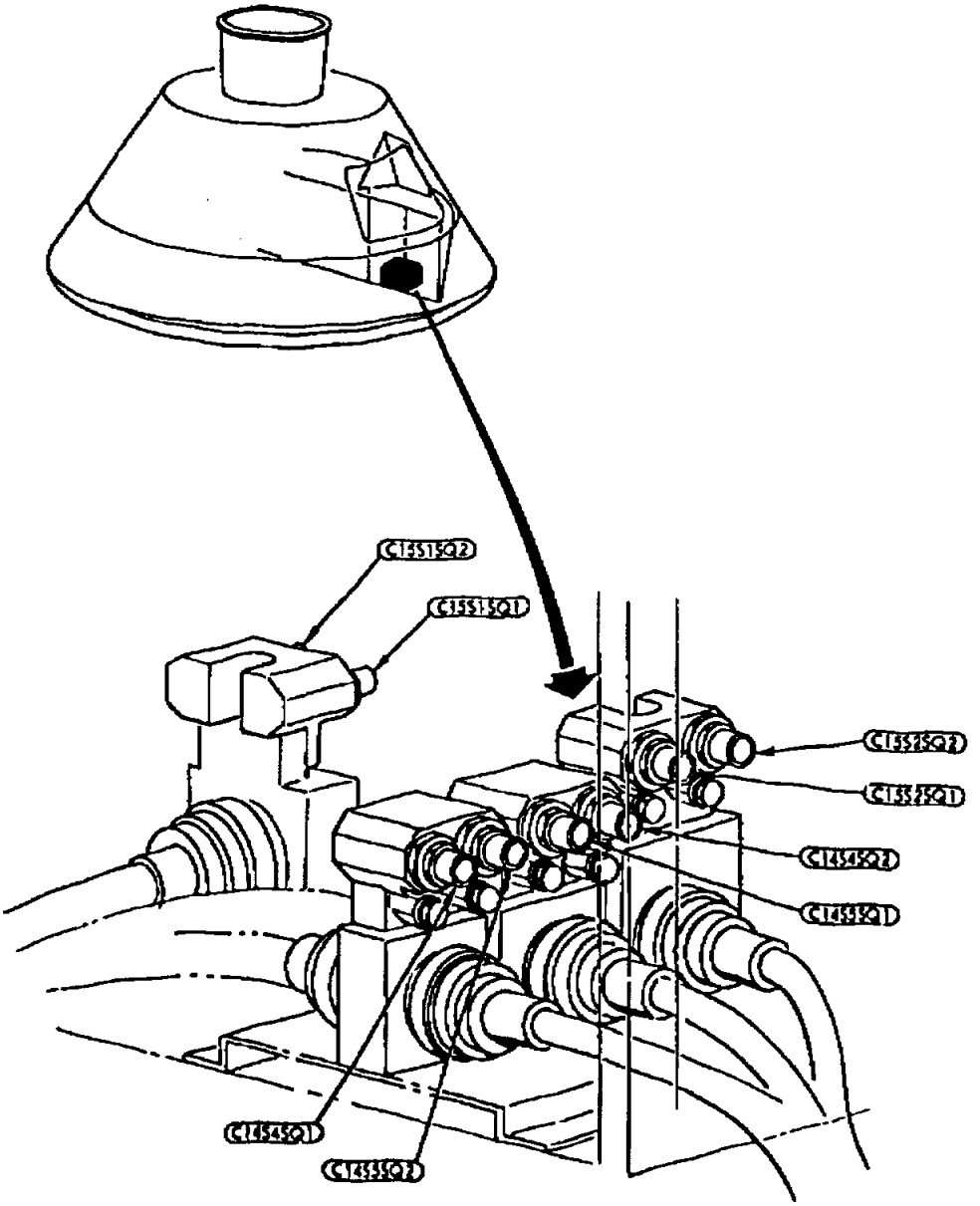


Figure 3-10. Forward Compartment Pyrotechnics (Sheet 2 of 2)



CM SM DEADFACE CIRCUIT INTERRUPTERS

SM-2A-1294A

Figure 3-11. Crew Compartment Pyrotechnics

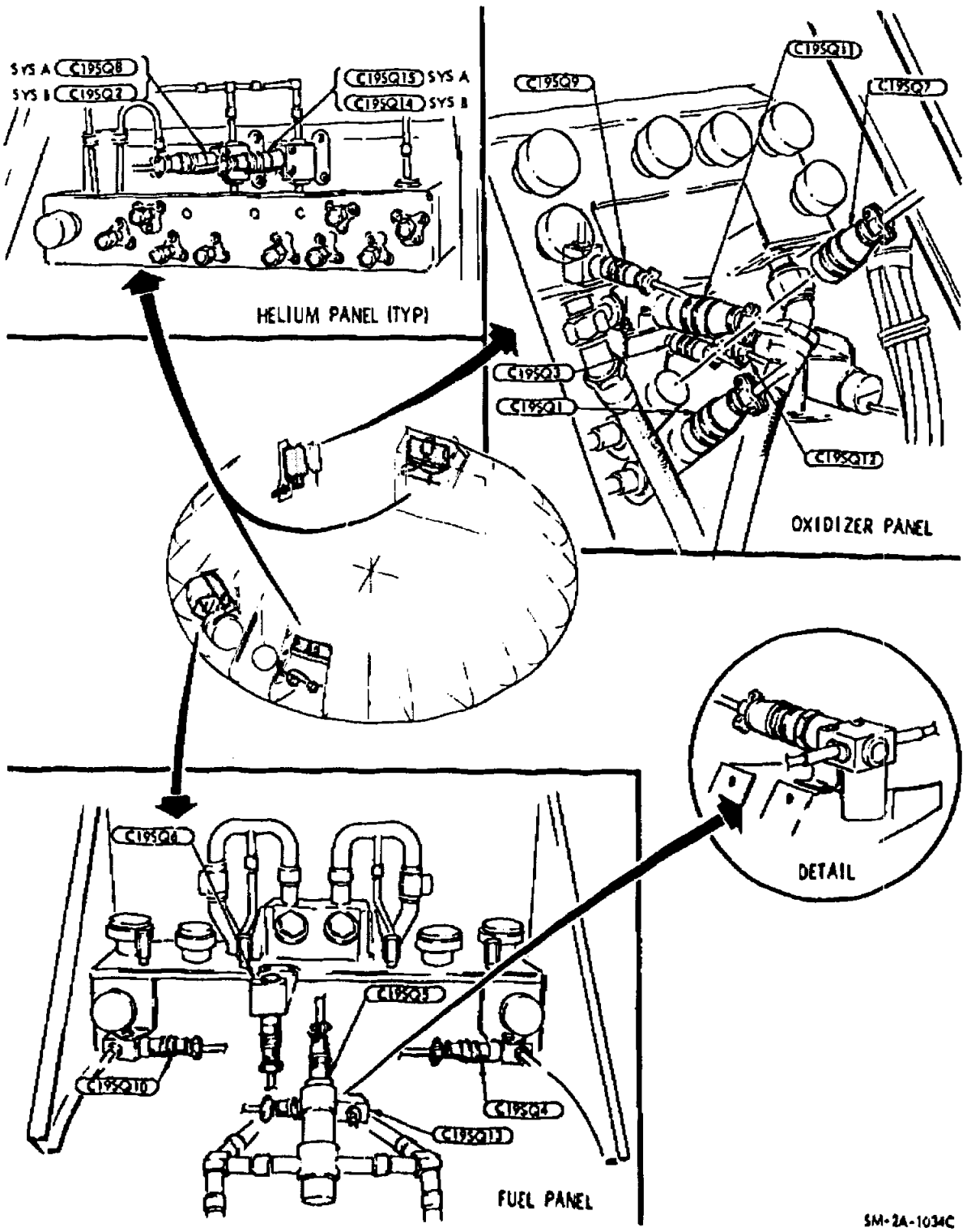
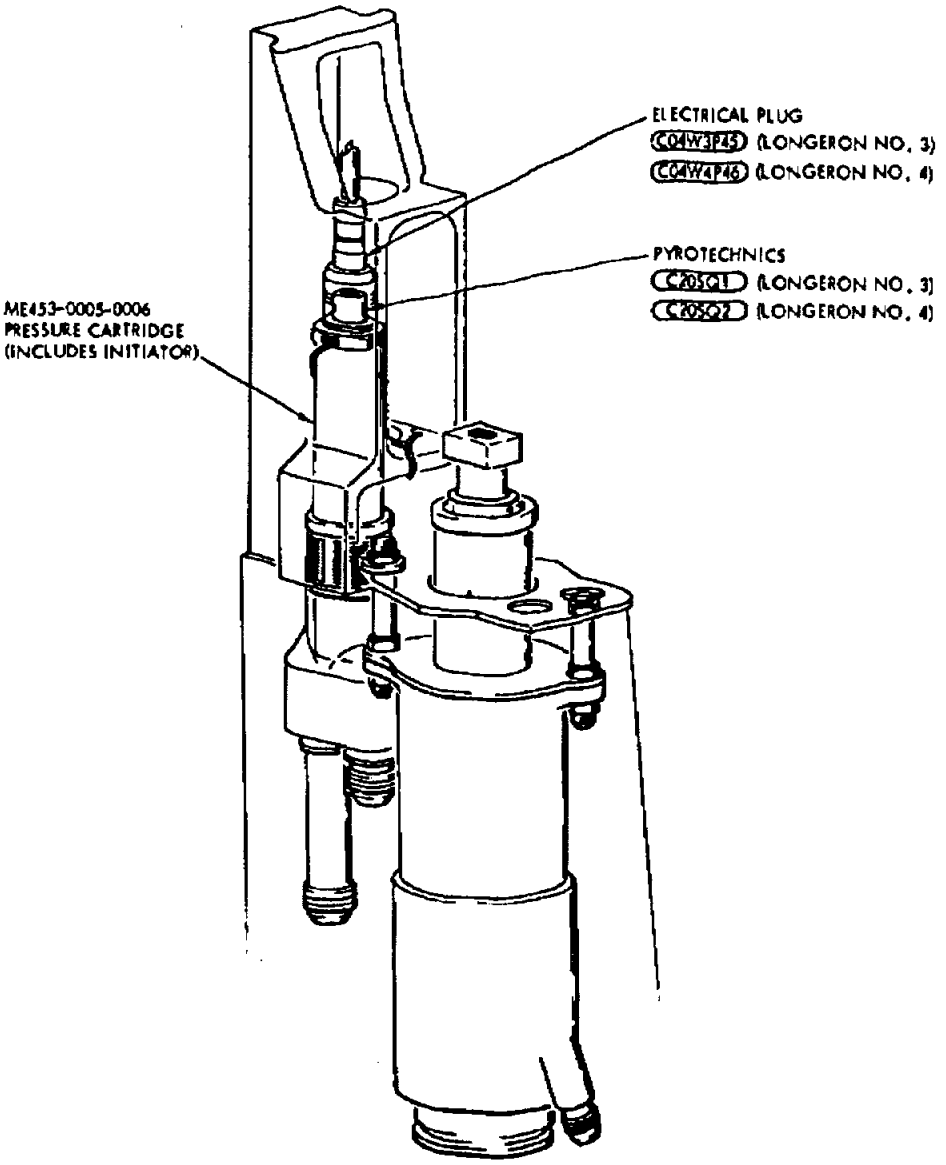


Figure 3-12. Aft Compartment Pyrotechnics



FORWARD HEAT SHIELD THRUSTER

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Figure 3-13. Forward Heat Shield Thruster

c. Record (fired or unfired) condition in paragraph 3-56 of each pressure cartridge inspected and tested.

d. Flag each unfired pressure cartridge with a red streamer or other distinctive identification.

NOTE

Compliance with steps e and f shall be determined by the NASA LST Director.

e. Carefully remove each UNFIRED pressure cartridge, with initiator intact, and apply suitable protective covering to opening in thruster breech.

CAUTION

Pressure cartridges are to be individually wrapped and bagged.

f. Wrap pressure cartridge in aluminum foil, place foil-wrapped cartridge in a plastic bag, then seal bag and place in the ordnance shipping container provided.

3-31. PARACHUTE SUBSYSTEM

3-32. The parachute subsystem consists of two drogue parachutes, three pilot parachutes, and three main landing parachutes. The pyrotechnic devices to be concerned with regarding safety after CM recovery include two drogue chute mortars, one dual drogue chute release, three pilot chute mortars, and two main chute releases. See figure 3-10 for location of components.

3-33. DROGUE CHUTE MORTARS. The drogue parachutes are mortar-deployed by a pair of mortars located on either side of the negative pitch RCS engines which are located on the -Z side of the CM top deck. Redundant gas pressure cartridges are fired by redundant circuitry which generates gas pressure within the mortar to expel the parachute by actuating a Sabot (piston) which forces the parachute to shear the pins that hold the mortar cover in place. Firing of either pressure cartridge will ignite the other one sympathetically.

3-34. SAFING DROGUE CHUTE MORTARS. See figures 3-10 and 3-14, and safe the drogue chute mortars as follows:

NOTE

- Compliance with steps a through j shall be determined by the NASA LST Director.
- To gain access to mortar-pressure cartridges, the mortar must be removed.

WARNING

- If a drogue chute mortar has failed to fire, keep personnel away from direct line with mortar muzzle.
- Ensure that electrical ground is maintained from mortar to top deck structure during mortar safing and removal.

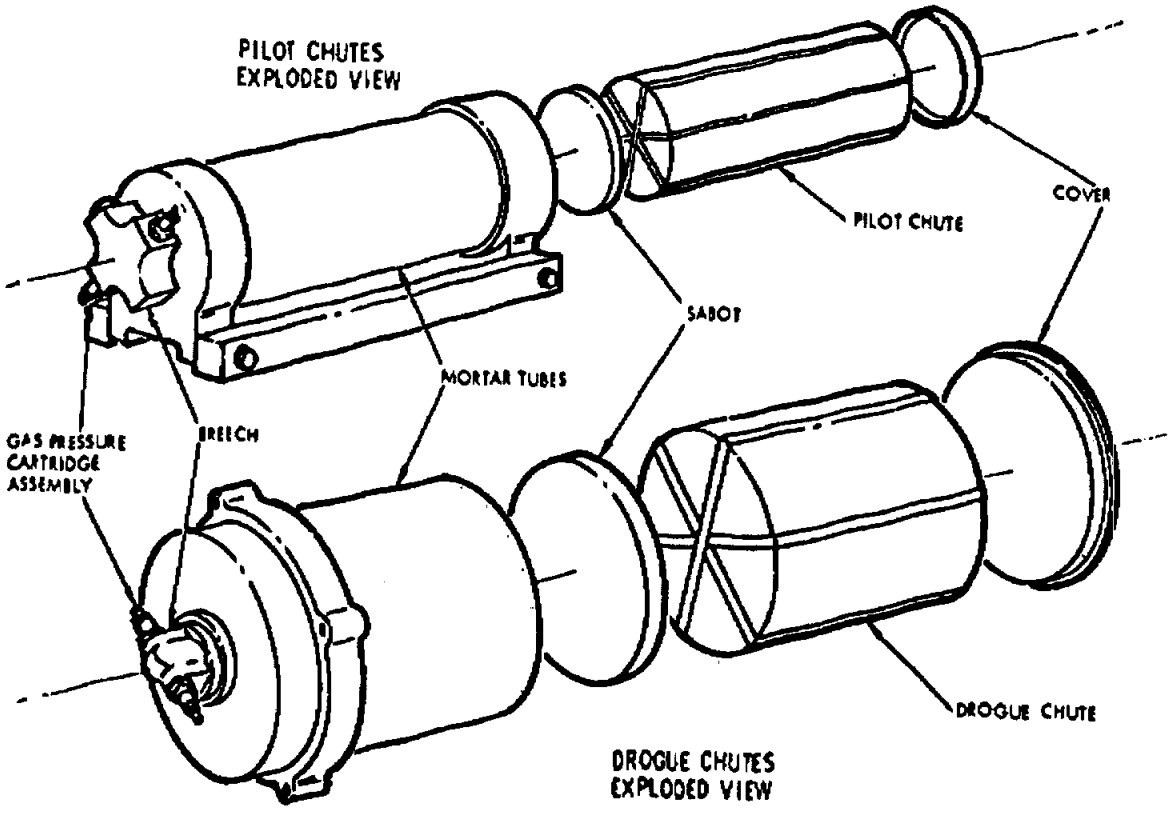

Figure 3-14. Drogue Chute and Pilot Chute Mortars

a. On drogue chute mortars No. 1 and No. 2, remove four NAS1004-16A bolts from mortar base.

b. Remove grounding straps.

c. Carefully slide mortar outboard to gain access to pressure cartridge electrical connectors.

d. Refer to items 15 through 18 (paragraph 3-56) for identity of pressure cartridges and electrical connectors on drogue chute mortars No. 1 and No. 2.

e. Verify condition of pressure cartridges by performing igniter circuit test in paragraph 3-54.

f. Record (fired or unfired) condition in paragraph 3-56 of each pressure cartridge inspected and tested.

g. Flag each unfired pressure cartridge with a red streamer or other distinctive identification.

h. Carefully remove each UNFIRED pressure cartridge, with initiator intact, and apply suitable protective covering to opening in mortar breech.

CAUTION

Pressure cartridges are to be individually wrapped and bagged.

i. Wrap pressure cartridge in aluminum foil, place foil-wrapped cartridge in a plastic bag, then seal bag and place in ordnance shipping container provided.

j. Reinstall mortars in reverse order of removal.

3-35. DUAL DROGUE CHUTE RELEASE. The drogue risers are attached to the CM forward compartment structure through a flat, thin tension fitting (blade). Two flexible linear-shaped charge (FLSC) cutter assemblies straddle the blade. To jettison the drogue parachutes, the two FLSC cutters are fired by detonator cartridges which sever the blade. This allows the hinge portion of the blade to slide through the mounting bracket and drift away from the CM on the drogue parachutes. Each of the FLSC cutters has the capability of cutting the blade in the event of failure of the other cutting charge. (See figure 3-15.)

3-36. SAFING DROGUE CHUTE RELEASE. See figures 3-10 and 3-15, and safe the drogue chute release as follows:

WARNING

- Ensure that electrical ground is maintained from drogue release fittings to top deck structure during ordnance safing and removal.
- If an UNFIRED or PARTIALLY FIRED condition is apparent, provide protective measures for the safing personnel as determined by the NASA LST Director.

a. Refer to items 5 and 6 (paragraph 3-56) for identity of detonator cartridges and electrical connectors on drogue chute release assembly.

b. Verify condition of detonator cartridges by performing igniter circuit test in paragraph 3-54.

c. Record (fired or unfired) condition in paragraph 3-56 of each detonator cartridge inspected and tested.

d. Flag each unfired detonator cartridge with a red streamer or other distinctive identification.

e. Visually inspect inboard and outboard FLSC cutters (V16-576260 and V16-576260-11) for the condition of the Eccofoam Seal over the face of the FLSC, and record condition of FLSC (fired, unfired, or partially fired) in paragraph 3-56.

NOTE

- The Eccofoam Seal in its normal state appears reddish in color. The color will be uniform throughout the length of the FLSC cutter if the FLSC has not fired.
- If the FLSC has partially fired, the Eccofoam Seal will be partly burned (blackened). The blackened area will start at the detonator cartridge end of the cutter and radiate away from it.
- When an FLSC cutter has fully fired, the entire FLSC cutter channel will be empty and blackened, and will probably be deformed.

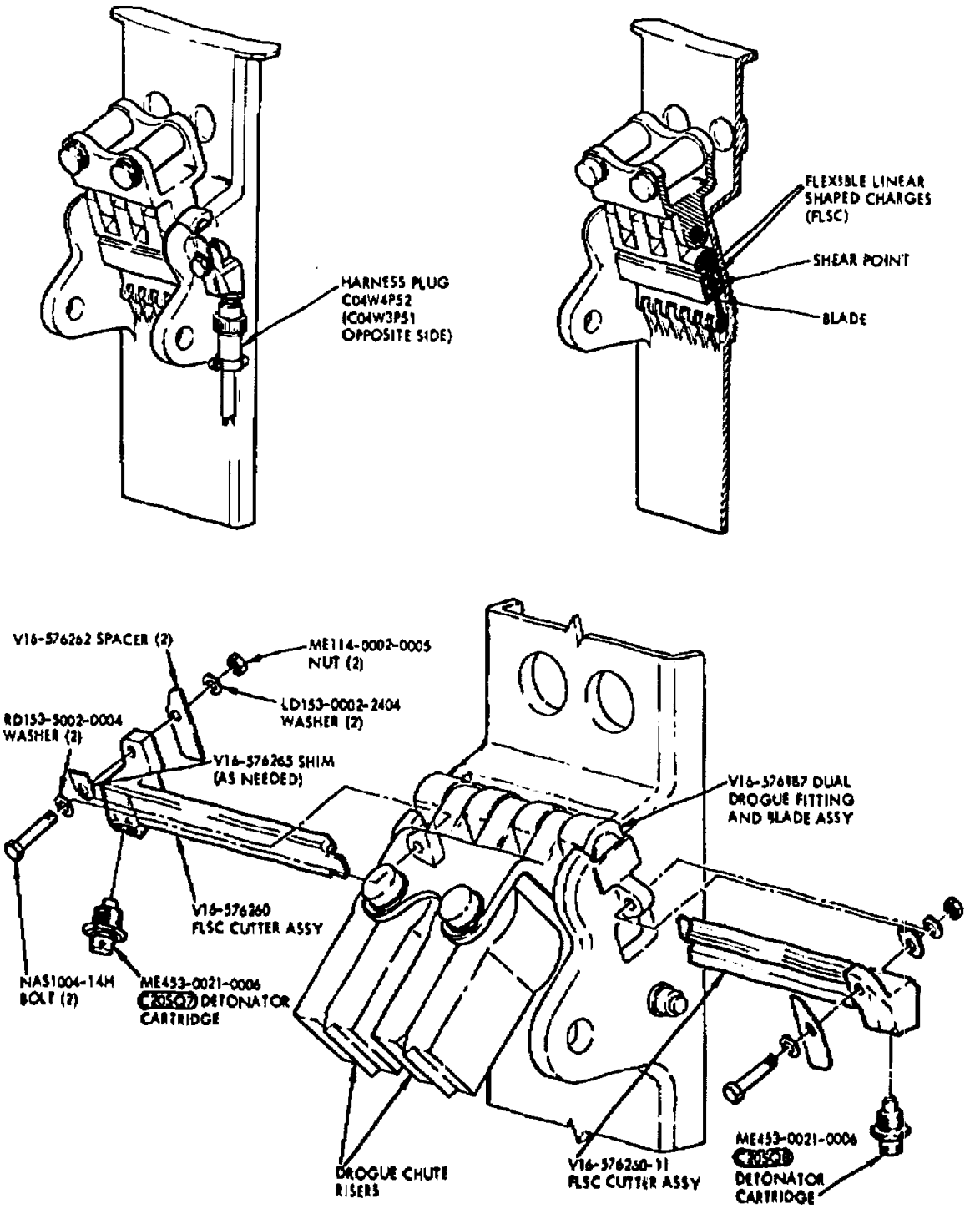

Figure 3-15. Dual Drogue Chute Release

f. Using results of steps b through e, determine which of the following conditions apply:

Condition A - 1. Drogue chutes released

2. Blade severed

3. Both detonator cartridges fired

4. FLSC cutter channels empty and deformed.

Condition B - 1. Drogue chutes released

2. Blade severed

3. One detonator cartridge fired, one unfired

4. One FLSC cutter channel empty; one FLSC cutter Eccofoam Seal charred from heat.

Condition C - 1. Drogue chutes released

2. Blade severed

3. Both detonator cartridges fired

4. One FLSC cutter channel empty; one FLSC cutter Eccofoam Seal partially burned.

Condition D - 1. Drogue chutes attached

2. Blade intact

3. Both detonator cartridges unfired

4. Both FLSC cutters unaffected.

WARNING

If an attempt is made to back the detonator cartridge from the breech of a partially fired FLSC cutter, the FLSC may be set off with possible injury to personnel.

g. If Condition A applies, the drogue release system has functioned properly and safing is complete.

h. If Condition B applies, verify unfired detonator cartridge has been flagged. Any further disposition of the unfired ordnance shall be determined by the NASA LST Director.

i. If Condition C applies, flag the detonator cartridge of partially fired FLSC cutter. Any further disposition of the partially fired ordnance shall be determined by the NASA LST Director.

j. If Condition D applies, verify both detonator cartridges have been flagged and proceed as follows:

1. Carefully remove each UNFIRED detonator cartridge with initiator intact, and apply suitable protective covering to opening in FLSC cutter breech.

CAUTION

Detonator cartridges are to be individually wrapped and bagged.

2. Wrap detonator cartridge in aluminum foil, place foil-wrapped cartridge in a plastic bag, then seal bag and place in ordnance shipping container provided.

3. See figure 3-15, and remove NAS1004-14H bolts securing FLSC cutter assemblies in drogue release assembly.

4. Carefully withdraw each FLSC cutter assembly.

CAUTION

- FLSC cutters are to be individually wrapped and bagged.
- Do not package FLSC cutters and detonator cartridges in the same shipping container.

5. Wrap FLSC cutter assembly in aluminum foil, place foil-wrapped FLSC cutter in a plastic bag, then seal bag and place in ordnance shipping container provided.

6. Reinstall NAS1004-14H bolts on drogue release assembly.

3-37. PILOT CHUTE MORTARS. Three pilot parachutes are packed in individual mortars beside their respective main landing parachutes. Redundant gas pressure cartridges are fired by redundant circuitry which generates gas pressure within the mortar to expel the parachute by actuating a Sabot (piston) which forces the parachute to shear the pins that hold the mortar cover in place. Firing of either gas pressure cartridge will ignite the other one sympathetically. (See figure 3-14.)

3-38. SAFING PILOT CHUTE MORTARS. See figures 3-10 and 3-14, and safe the pilot chute mortars as follows:

NOTE

- Compliance with steps a through j shall be determined by the NASA LST Director.
- To gain access to mortar pressure cartridges, the mortar must be removed.

WARNING

- If a pilot chute mortar has failed to fire, keep personnel away from direct line with mortar muzzle.
- Ensure that electrical ground is maintained from mortar to top deck structure during mortar safing and removal.

a. On pilot chute mortars No. 1, No. 2, and No. 3, remove NAS1136C-B2 bolt at outboard end of mortar.

b. Carefully slide mortar inboard until V16-576162-3 pin is disengaged from slots at inboard end of mortar mount assembly.

c. Slide mortar outboard to gain access to pressure cartridge electrical connectors.

d. Refer to items 9 through 14 (paragraph 3-56) for identity of pressure cartridges and electrical connectors on pilot chute mortars No. 1, No. 2, and No. 3.

e. Verify condition of pressure cartridges by performing igniter circuit test in paragraph 3-54.

f. Record (fired or unfired) condition in paragraph 3-56 of each pressure cartridge inspected and tested.

g. Flag each unfired pressure cartridge with a red streamer or other distinctive identification.

h. Carefully remove each UNFIRED pressure cartridge with initiator intact, and apply suitable protective covering to opening in mortar breech.

CAUTION

Pressure cartridges are to be individually wrapped and bagged.

i. Wrap pressure cartridge in aluminum foil, place foil-wrapped cartridge in a plastic bag, then seal bag and place in ordnance shipping container provided.

j. Reinstall mortars in reverse order of removal.

3-39. MAIN CHUTE RELEASE. The main landing parachutes are attached to the top deck structure at longerons No. 3 and No. 4. (See figures 3-10 and 3-16.) Detonator cartridges are employed for actuating the main chute releases. After landing, the initiator of each main chute release will be fired igniting the single detonator cartridge at each attachment fitting. The detonator cartridge drives a cutting blade inside the attachment fitting which will sever the nylon harness. The main landing parachutes, their risers, the confluence fitting, and the harness assembly are then free to drop from the CM into the water.

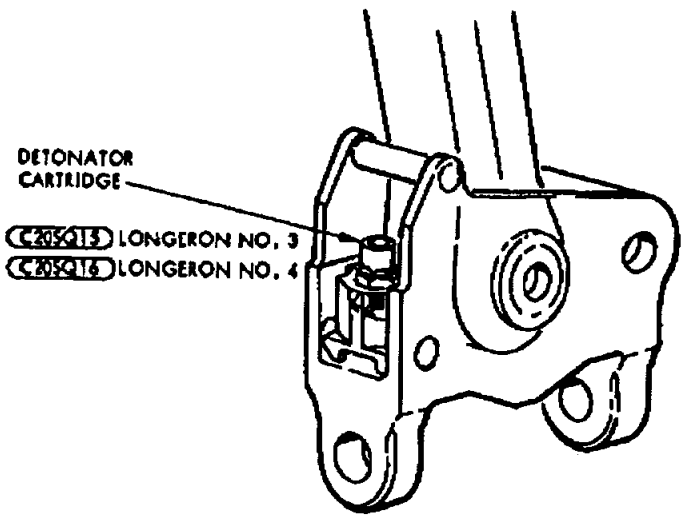

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Figure 3-16. Main Chute Release

3-40. SAFING MAIN CHUTE RELEASE. See figures 3-10 and 3-16, and safe the main chute releases as follows:

a. Refer to items 7 and 8 (paragraph 3-56) for identity of detonator cartridges and electrical connectors on main chute releases.

b. Verify condition of detonator cartridges by performing igniter test in paragraph 3-54.

c. Record (fired or unfired) condition in paragraph 3-56 of each detonator cartridge inspected and tested.

3-41. HF ANTENNA ASSEMBLY

3-42. The HF antenna assembly is mounted on the forward compartment in the -Z bay adjacent to the -Y attachment fitting. (See figures 3-10 and 3-17.) The HF antenna deploy mechanism is actuated by the explosive force of two hotwire initiators. When the initiators are fired, the cover of the HF antenna container opens allowing the antenna to deploy. At the same time, the cover triggers the non-explosive initiator of the dye marker.

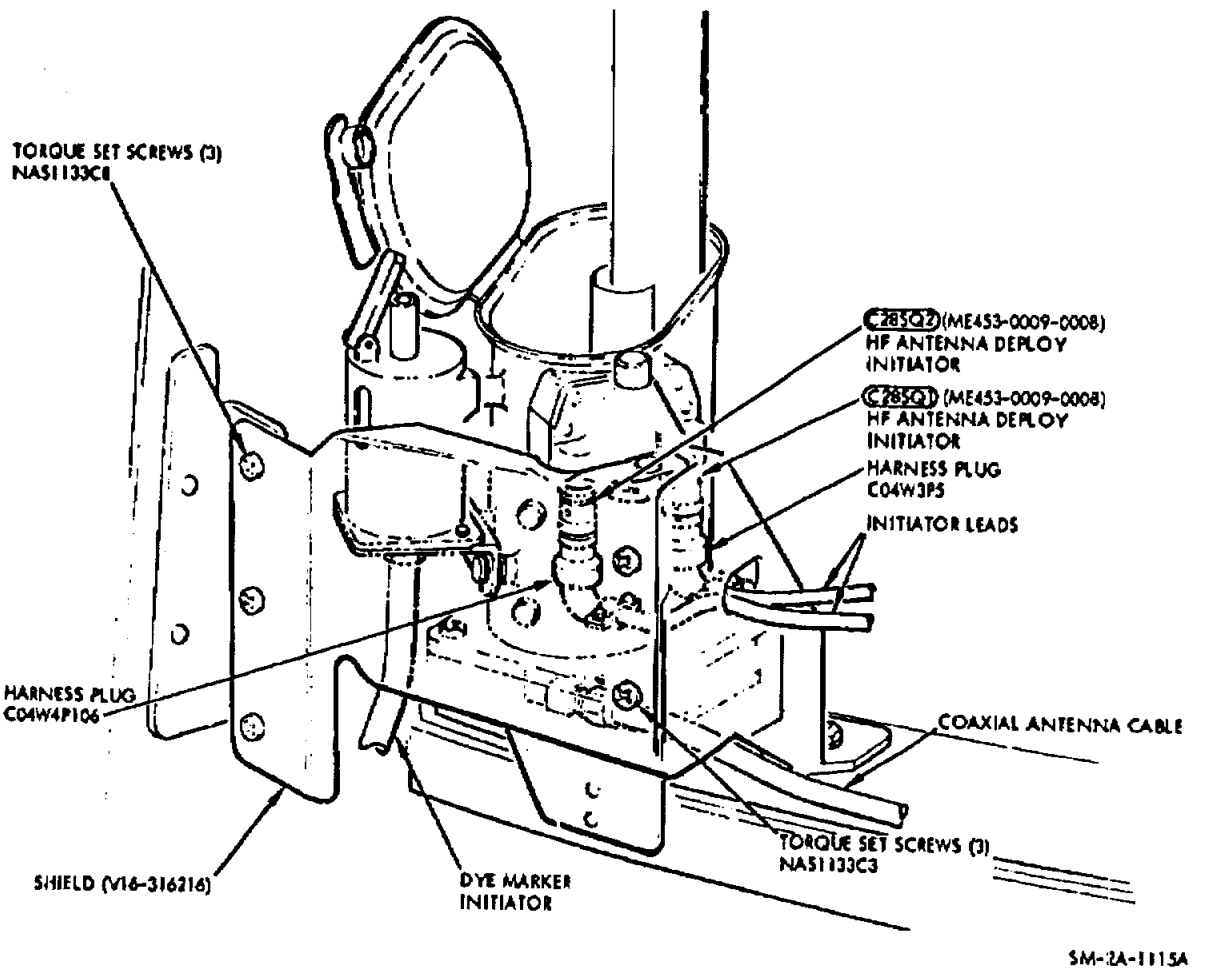


Figure 3-17. HF Antenna Assembly

3-43. SAFING HF ANTENNA ASSEMBLY. See figures 3-10 and 3-17, and safe the HF antenna assembly as follows:

NOTE

Compliance with steps a through f shall be determined by the NASA LST Director.

WARNING

If HF antenna has failed to deploy, keep all parts of the body clear of the antenna cover assembly and from a line extending directly above the cover assembly.

a. To gain access to the initiators, remove V16-316216 shield by removing three NAS113C8 torque setscrews and three NAS1133C3 torque setscrews.

b. Refer to items 3 and 4 (paragraph 3-56) for identity of initiators and electrical connectors on HF antenna deploy mechanism.

c. Verify condition of initiators by performing igniter circuit test in paragraph 3-54.

d. Record (fired or unfired) condition in paragraph 3-56 of each initiator inspected and tested.

e. Flat each unfired initiator with a streamer or other distinctive identification.

f. Reinstall shield on HF antenna container.

3-44. CM-SM DEADFACE CIRCUIT INTERRUPTERS

3-45. The circuit interrupter system (located in the crew compartment RHEB) (figure 3-11) consists of four circuit interrupter units. The units are ignited by hotwire initiators. Redundancy is provided by actuating each unit with two pressure cartridges. When fired, the gas pressure generated by either cartridge will force the piston through its complete travel. This breaks all electrical connections made through the interrupter and deadfaces the hot electrical circuits routed through it.

3-46. SAFING CIRCUIT INTERRUPTERS. See figure 3-11, and safe the crew compartment RHEB circuit interrupters as follows:

NOTE

Compliance with steps a through f shall be determined by the NASA LST Director.

a. To gain access to the circuit interrupters, remove the panel at the RHEB shown in figure 3-11.

b. Refer to items 19 through 26 (paragraph 3-56) for identify of pressure cartridges and electrical connectors on circuit interrupters.

c. Verify condition of pressure cartridges by performing igniter circuit test in paragraph 3-54.

d. Record (fired or unfired) condition in paragraph 3-56 of each pressure cartridge inspected and tested.

e. Flag each unfired pressure cartridge with a red streamer or other distinctive identification.

f. Reinstall panel at RHEB.

3-47. CM RCS SQUIB VALVE

3-48. The CM RCS incorporates 15 squib valves. Figure 3-18 illustrates a typical (normally closed) squib valve before and after being fired by an initiator. When the initiator is exploded, the gas pressure generated actuates a piston-driven cutting blade called the spool, which shears off the ends of the tubing and allows fluid flow through the port opening of the spool. These squib valves are located in the aft compartment on the system A helium panel, oxidizer panel, fuel panel, and the system B helium panel.

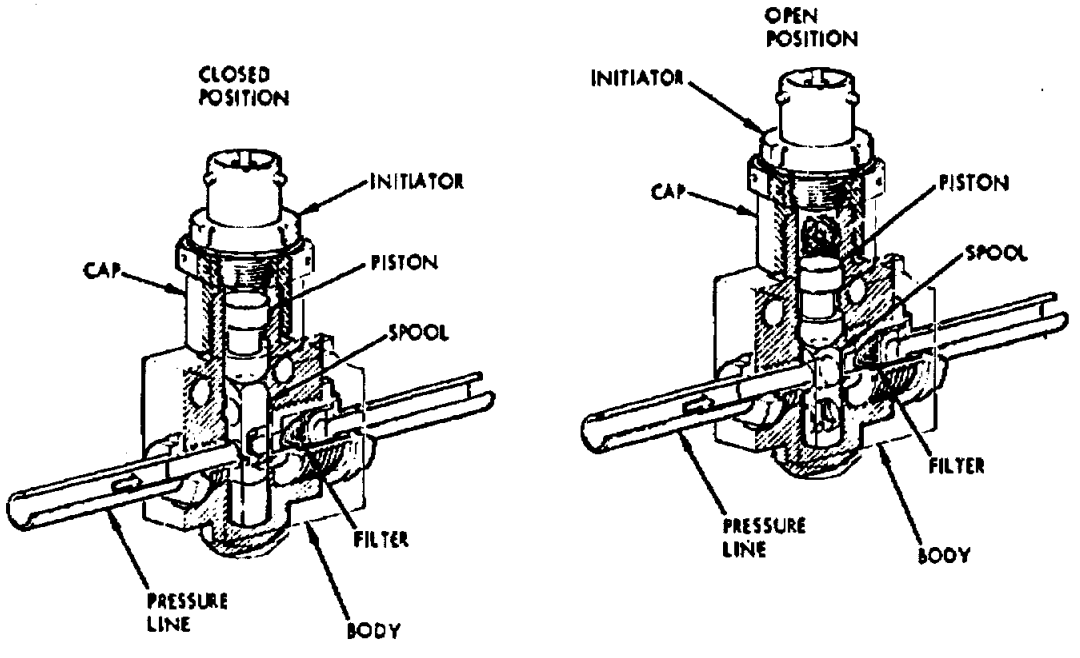


Figure 3-18. RCS Squib Valve (Typical)

3-49. Following a normal flight and recovery, the CM RCS should contain only three unfired squib valves (one helium dump and two oxidizer dump valves). However, to ensure positive safing of all explosive devices, it will be necessary to treat all such devices as if they are armed. The following chart lists the various explosive devices associated with RCS, together with the status of each following a normal mission, high-altitude abort, and a pad or low-altitude abort.

FUEL PANEL	Normal Mission or High-Altitude Abort	Pad or Low-Altitude Abort
He Interconnect	Open	Open
He-Fuel Bypass (System A)	Open	Closed*
He-Fuel Bypass (System B)	Open	Closed*
Fuel Interconnect	Open	Closed*
He Dump	Closed*	Open
OXIDIZER PANEL		
He Interconnect	Open	Open
He-Oxid Bypass (System A)	Open	Open
He-Oxid Bypass (System B)	Open	Open
Oxidizer Interconnect	Open	Open
Oxidizer Dump (System A)	Closed*	Open
Oxidizer Dump (System B)	Closed*	Open
HELIUM PANEL (SYSTEM A)		
He Isolation (2)	Open	Open
HELIUM PANEL (SYSTEM B)		
He Isolation (2)	Open	Open

*Indicates armed (live) explosive device.

3-50. SAFING SYSTEM A HELIUM PANEL SQUIB VALVES. See figures 3-12 and 3-18, and safe the squib valves on system A helium servicing panel as follows:

a. Refer to items 27 and 28 (paragraph 3-56) for identity of initiators and electrical connectors on squib valves at system A helium panel.

b. Verify condition of initiators by performing igniter circuit test in paragraph 3-54.

c. Record (fired or unfired) condition in paragraph 3-56 of each initiator inspected and tested.

d. Flag each unfired initiator with a red streamer or other distinctive identification.

3-51. SAFING FUEL PANEL SQUIB VALVES. See figures 3-12 and 3-18, and safe the squib valves on fuel servicing panel as follows:

a. Refer to items 37 through 41 (paragraph 3-56) for identity of initiators and electrical connectors on squib valves at fuel panel.

b. Verify condition of initiators by performing igniter circuit test in paragraph 3-54.

c. Record (fired or unfired) condition in paragraph 3-56 of each initiator inspected and tested.

d. Flag each unfired initiator with a red streamer or other distinctive identification.

3-52. SAFING OXIDIZER PANEL SQUIB VALVES. See figures 3-12 and 3-18, and safe the squib valves on oxidizer servicing panel as follows:

a. Refer to items 31 through 36 (paragraph 3-56) for identity of initiators and electrical connectors on squib valves at oxidizer panel.

b. Verify condition of initiators by performing igniter circuit test in paragraph 3-54.

c. Record (fired or unfired) condition in paragraph 3-56 of each initiator inspected and tested.

d. Flag each unfired initiator with a red streamer or other distinctive identification.

3-53. SAFING SYSTEM B HELIUM PANEL SQUIB VALVES. See figures 3-12 and 3-18, and safe the squib valves on system B helium servicing panel as follows:

a. Refer to items 29 and 30 (paragraph 3-56) for identity of initiators and electrical connectors on squib valves at system B helium panel.

b. Verify condition of initiators by performing igniter circuit test in paragraph 3-54.

c. Record (fired or unfired) condition in paragraph 3-56 of each initiator inspected and tested.

d. Flag each unfired initiator with a red streamer or other distinctive identification.

3-54. IGNITER CIRCUIT TESTING

3-55. Assume all ordnance as unfired and perform an igniter circuit test on each initiator of all pyrotechnic devices as follows:

WARNING

- Pyrotechnic inspection and safing shall be accomplished by certified ordnance personnel (NAA training course No. K-402, Handling and Processing of Explosives).
- Personnel responsible for dearming pyros shall wear garter grounding devices (LEGSTAT).

a. Disconnect electrical cable from initiator and stow.

b. Temporarily remove test leads from igniter circuit tester (figures 3-19 and 3-20) and connect appropriate (4-pin or 2-pin) lead of adapter switch box to initiator receptacle.

c. On adapter switch box, place toggle switch to OFF.

d. On igniter circuit tester, select the 1-ohm range and reconnect test leads.

e. On adapter switch box, select LEADS A&B position; then press test button on igniter circuit tester. Record condition of initiator in paragraph 3-56.

NOTE

- Normal reading of an unfired (live) initiator will be 0.90 to 1.20 ohm.
- Each initiator has two circuits, A&B and C&D. The system wiring indicates only circuit A&B is wired; however, for safety purposes, circuit C&D must also be tested.

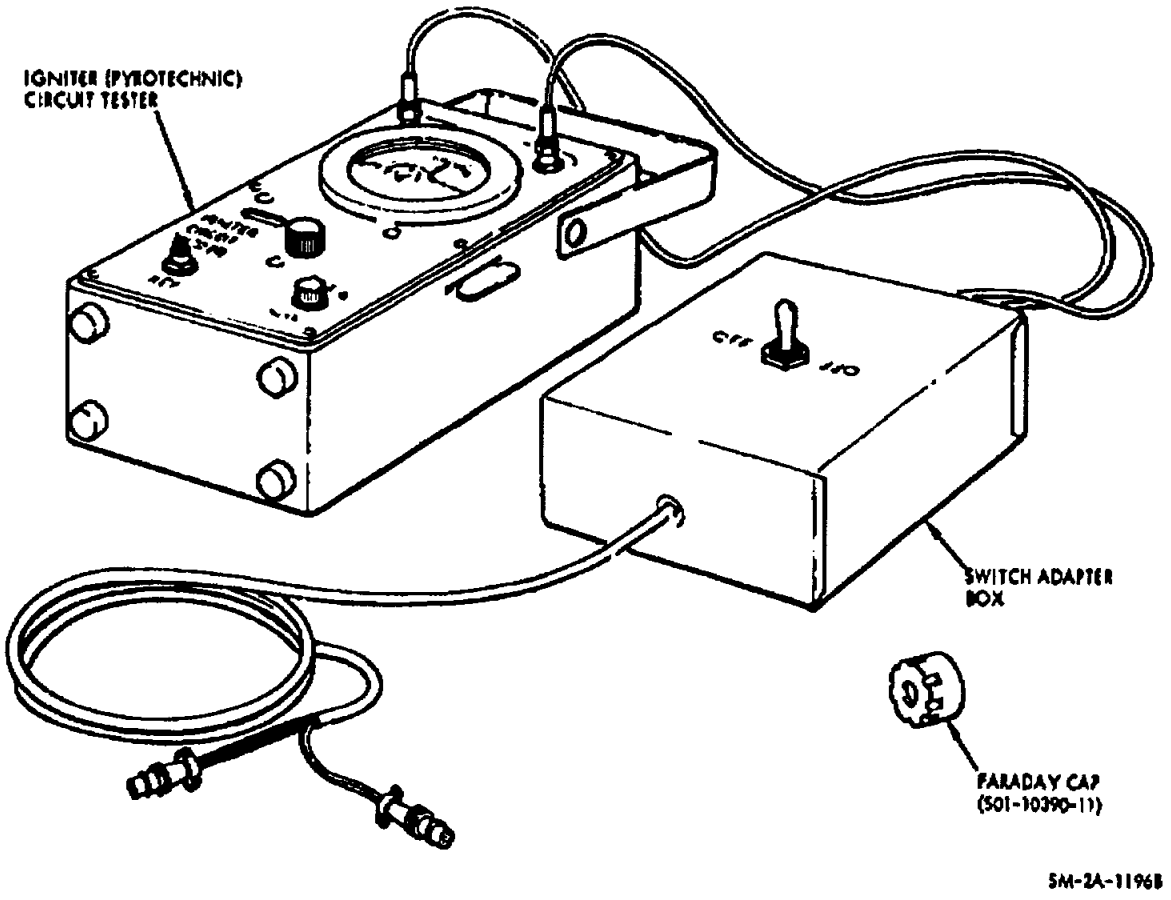


Figure 3-19. Pyrotechnic Test Equipment

f. Repeat step e for LEADS C&D position.

WARNING

Each live initiator must be flagged with a red streamer or distinctive identification.

g. Disconnect adapter switch lead from initiator.

h. Install safing (Faraday) cap S01-10390-11 on initiator immediately.

NOTE

Safing (shorting) plug S01-470 may be used as an alternate if safing cap S01-10390-11 is not available. If the shorting plug (S01-470) is used, it should be secured with tape.

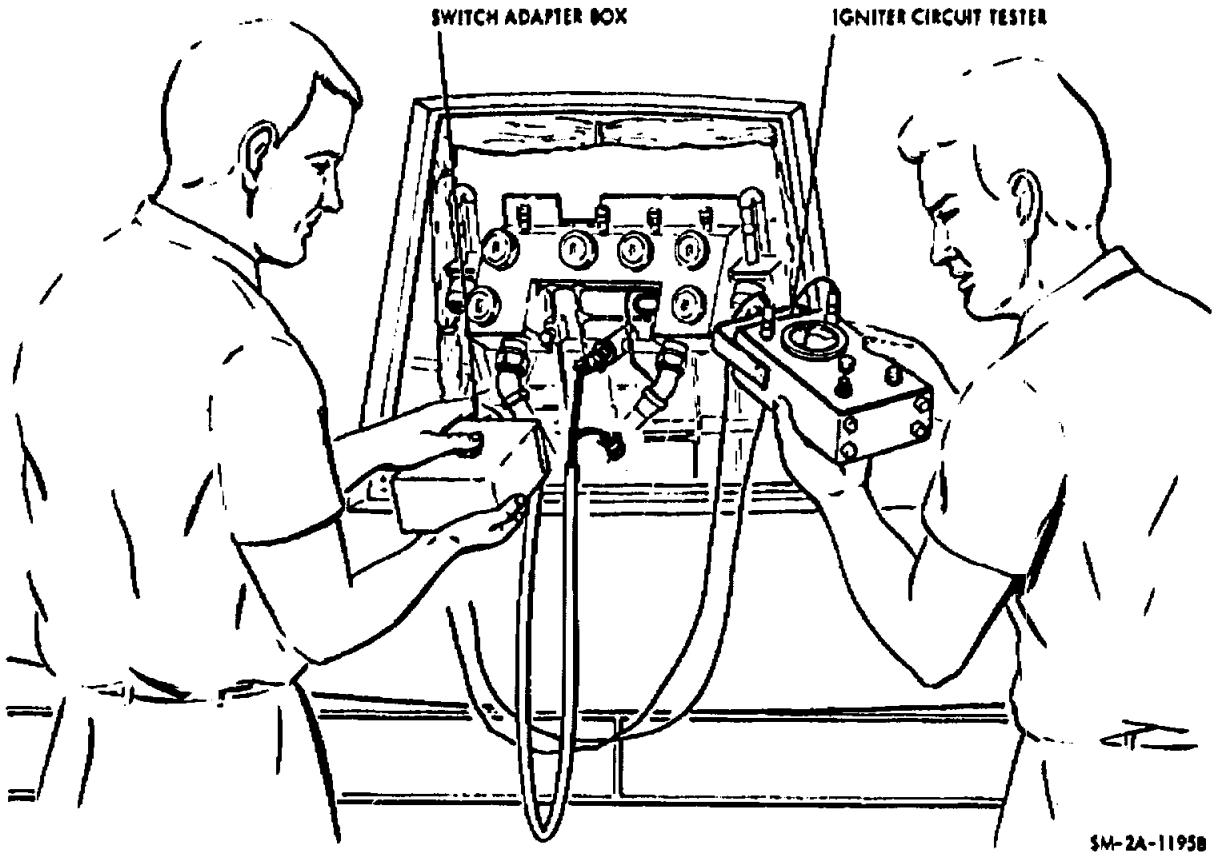


Figure 3-20. Pyrotechnic Safing (Typical)

3-56. RECORDING PYROTECHNIC CONDITION. When performing igniter circuit test on initiators, use the following form for documenting the status (as found condition) of each explosive device. (See figures 3-10, 3-11, and 3-12.)

Start Time_____

Item	Pyrotechnic Description/Location	Pyrotechnic/Connector Identification	Meter Reading	Condition	Technician
	FORWARD COMPARTMENT				
1	-Y FORWARD HEAT SHIELD THRUSTER, PRESSURE CARTRIDGE, LONGERON NO. 3	ME453-0005-0006 C04W3P45 (C20SQ1) Figures 3-10 and 3-13	A-B____OHMS C-D____OHMS		
2	+Y FORWARD HEAT SHIELD THRUSTER, PRESSURE CARTRIDGE, LONGERON NO. 4	ME453-0005-0006 C04W4P46 (C20SQ2) Figures 3-10 and 3-13	A-B____OHMS C-D____OHMS		
3	HF ANTENNA, INITIATOR, INBD (REAR)	ME453-0009-0008 C04W4P5 (C28SQ1) Figures 3-10 and 3-13	A-B____OHMS C-D____OHMS		
4	HF ANTENNA, INITIATOR OUTBD (FRONT)	ME453-0009-0008 C04W4P106 (C28SQ2) Figures 3-10 and 3-17	A-B____OHMS C-D____OHMS		
5	DROGUE RELEASE, DETONATOR CARTRIDGE, LH	ME453-0021-0006 C04W3P51 (C20SQ7) Figures 3-10 and 3-15	A-B____OHMS C-D____OHMS		
	DROGUE RELEASE, FLSC CUTTER, LH	V16-576260 Figure 3-15	____ ____ ____ ____		
6	DROGUE RELEASE, DETONATOR CARTRIDGE, RH	ME453-0021-0006 C04W4P52 (C20SQ8) Figures 3-10 and 3-15	A-B____OHMS C-D____OHMS		

Item	Pyrotechnic Description/Location	Pyrotechnic/Connector Identification	Meter Reading	Condition	Technician
	DROGUE RELEASE, FLSC CUTTER, RH	V16-576260-11 Figure 3-15			
7	-Y MAIN CHUTE RELEASE, DETONATOR CARTRIDGE, LONGERON NO. 3	ME453-0005-0202 (LEFT HAND THREAD) C04W3P59 (C20SQ15) Figures 3-10 and 3-16	A-B ____ OHMS C-D ____ OHMS		
8	+Y MAIN CHUTE RELEASE, DETONATOR CARTRIDGE, LONGERON NO. 4	ME453-0005-0202 (LEFT HAND THREAD) C04W4P60 (C20SQ16) Figures 3-10 and 3-16	A-B ____ OHMS C-D ____ OHMS		
9	+Y PILOT CHUTE MORTAR (NO. 1), PRESSURE CARTRIDGE, RH (UPPER)	ME453-0005-0002 C04W3P53 (C20SQ9) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
10	+Y PILOT CHUTE MORTAR (NO. 1), PRESSURE CARTRIDGE, LH (LOWER)	ME453-0005-0002 C04W4P54 (C20SQ10) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
11	+Z PILOT CHUTE MORTAR (NO. 2) PRESSURE CARTRIDGE, RH (UPPER)	ME453-0005-0002 C04W3P55 (C20SQ11) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
12	+Z PILOT CHUTE MORTAR (NO. 2) PRESSURE CARTRIDGE, LH (LOWER)	ME453-0005-0002 C04W4P56 (C20SQ12) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		

Item	Pyrotechnic Description/Location	Pyrotechnic/Connector Identification	Meter Reading	Condition	Technician
13	-Y PILOT CHUTE MORTAR (NO. 3) PRESSURE CARTRIDGE, RH (UPPER)	ME453-0005-0002 C04W3P57 (C20SQ13) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
14	-Y PILOT CHUTE MORTAR (NO. 3) PRESSURE CARTRIDGE, LH (LOWER)	ME453-0005-0002 C04W4P58 (C20SQ14) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
15	NO. 1 DROGUE CHUTE MORTAR, PRESSURE CARTRIDGE, RH (OUTBD)	ME453-0005-0001 C04W3P47 (C20SQ3) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
16	NO. 1 DROGUE CHUTE MORTAR, PRESSURE CARTRIDGE, LH (INBD)	ME453-0005-0001 C04W4P48 (C20SQ4) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
17	NO. 2 DROGUE CHUTE MORTAR, PRESSURE CARTRIDGE, RH (INBD)	ME453-0005-0001 C04W3P49 (C20SQ5) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
18	NO. 2 DROGUE CHUTE MORTAR, PRESSURE CARTRIDGE, LH (OUTBD)	ME453-0005-0001 C04W4P50 (C20SQ6) Figures 3-10 and 3-14	A-B ____ OHMS C-D ____ OHMS		
	CREW COMPARTMENT				
19	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P81 (C14S4SQ1) Figure 3-11	A-B ____ OHMS C-D ____ OHMS		

Item	Pyrotechnic Description/Location	Pyrotechnic/Connector Identification	Meter Reading	Condition	Technician
20	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P83 (C14S4SQ2) Figure 3-11	A-B ____OHMS C-D ____OHMS		
21	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P82 (C14S5SQ1) Figure 3-11	A-B ____OHMS C-D ____OHMS		
22	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P84 (C14S5SQ2) Figure 3-11	A-B ____OHMS C-D ____OHMS		
23	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P87 (C15S1SQ1) Figure 3-11	A-B ____OHMS C-D ____OHMS		
24	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P89 (C15S1SQ2) Figure 3-11	A-B ____OHMS C-D ____OHMS		
25	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P88 (C15S2SQ1) Figure 3-11	A-B ____OHMS C-D ____OHMS		
26	RHEB CIRCUIT INTERRUPTER, PRESSURE CARTRIDGE	ME453-0005-0054 C03W2P90 (C15S2SQ2) Figure 3-11	A-B ____OHMS C-D ____OHMS		

Item	Pyrotechnic Description/Location	Pyrotechnic/Connector Identification	Meter Reading	Condition	Technician
	AFT COMPARTMENT				
	System A Helium Panel (Figures 3-12 and 3-18) Frames 24-1				
27	HELIUM ISOLATION VALVE INITIATOR LH (GREEN)	ME453-0005-0121 C05W3P74 (C19SQ8)	A-B OHMS C-D OHMS		
28	HELIUM ISOLATION VALVE INITIATOR RH (RED)	ME453-0005-0121 C05W3P481 (C19SQ15)	A-B OHMS C-D OHMS		
	System B Helium Panel (Figures 3-12 and 3-18) Frames 12-13				
29	HELIUM ISOLATION VALVE, INITIATOR, LH (RED-YELLOW)	ME453-0005-0121 C05W3P68 (C19SQ2)	A-B OHMS C-D OHMS		
30	HELIUM ISOLATION VALVE, INITIATOR, RH (RED-GREEN)	ME453-0005-0121 C05W3P480 (C19SQ14)	A-B OHMS C-D OHMS		
	Oxidizer Panel (Figures 3-12 and 3-18) Frames 3-4				
31	HE-OXID BYPASS VALVE INITIATOR, SYSTEM A (GREEN)	ME453-0005-0111 C05W2P75 (C19SQ9)	A-B OHMS C-D OHMS		
32	HE-OXID BYPASS VALVE INITIATOR, SYSTEM B (RED)	ME453-0005-0111 C05W2P69 (C19SQ3)	A-B OHMS C-D OHMS		
33	OXIDIZER DUMP VALVE INITIATOR, SYSTEM B, OUTBD (WHITE)	ME453-0005-0034 C05W2P67 (C19SQ1)	A-B OHMS C-D OHMS		
34	OXIDIZER DUMP VALVE INITIATOR, SYSTEM A, INBD (GRAY)	ME453-0005-0034 C05W2P73 (C19SQ7)	A-B OHMS C-D OHMS		

Item	Pyrotechnic Description/Location	Pyrotechnic/Connector Identification	Meter Reading	Condition	Technician
35	OXIDIZER INTERCONNECT VALVE INITIATOR (YELLOW)	ME453-0005-1034 (LEFT-HAND THREAD) C05W2P77 (C19SQ11)	A-B —— OHMS C-D —— OHMS		
36	HELIUM INTERCONNECT VALVE INITIATOR (ORANGE)	ME453-0005-0122 (LEFT-HAND THREAD) C05W2P78 (C19SQ12)	A-B —— OHMS C-D —— OHMS		
	Fuel Panel (Figures 3-12 and 3-18) Frames 9-13				
37	HELIUM INTERCONNECT VALVE INITIATOR (YELLOW)	ME453-0005-0122 (LEFT HAND THREAD) C05W2P72 (C19SQ6)	A-B ——OHMS C-D ——OHMS		
38	HELIUM DUMP VALVE INITIATOR	ME453-0005-0141 C05W2P477 (C19SQ13)	A-B ——OHMS C-D ——OHMS		
39	HE-FUEL BYPASS VALVE INITIATOR, SYSTEM A, LH (RED)	ME453-0005-0121 C05W2P76 (C19SQ10)	A-B ——OHMS C-D ——OHMS		
40	HE-FUEL BYPASS VALVE INITIATOR, SYSTEM B, RH (ORANGE)	ME453-0005-0121 C05W2P70 (C19SQ4)	A-B ——OHMS C-D ——OHMS		
41	FUEL INTERCONNECT VALVE INITIATOR (GREEN)	ME453-0005-0034 C05W2P71 (C19SQ5)	A-B ——OHMS C-D ——OHMS		

Completion Time _____

Recorded by: _____

Date _____

3-57. RCS INSPECTION.

3-58. Shortly after arrival of the CM, and prior to initiating deactivation operations, accessible RCS components and exterior surface areas shall be inspected. Information relative to exterior surface and internal component inspection are provided within paragraph 3-60. Prior to accomplishing the internal component inspection, it will be necessary to remove the RCS access panels. (Refer to paragraph 3-59.)

3-59. ACCESS PANEL REMOVAL. Initial removal of the RCS access panels will normally be accomplished aboard the recovery vessel; accordingly, removal at the deactivation site will be a relatively simple task. However, if the panels have not been removed, it will be necessary to accomplish the following steps:

a. Remove ablator plugs (figure 3-21) as follows:

1. Using a wire brush or screwdriver, scrape away charred area to locate ablator plugs.

2. Using a No. 32 drill, remove RTV compound from ablator plug installation holes.

3. Using prong tool, remove ablator plugs. Plugs which cannot be removed in this manner shall be drilled out, using a 1/2-inch auger bit and brace, or a pneumatic drill with a 1/2-inch bit.

b. Following ablative plug removal, remove access panels (figure 3-22) per the following instructions:

WARNING

Observe normal safety precautions when entering RCS access areas; if leaks are apparent, stand clear.

1. Using a torque-set screwdriver, loosen all screws one turn (counterclockwise).

2. Remove and bag screws.

3. Install 5-inch bolts, one or two on each side of the panel. (See figure 3-22.)

4. Grasp 5-inch bolts; using a wobble motion, withdraw panel.

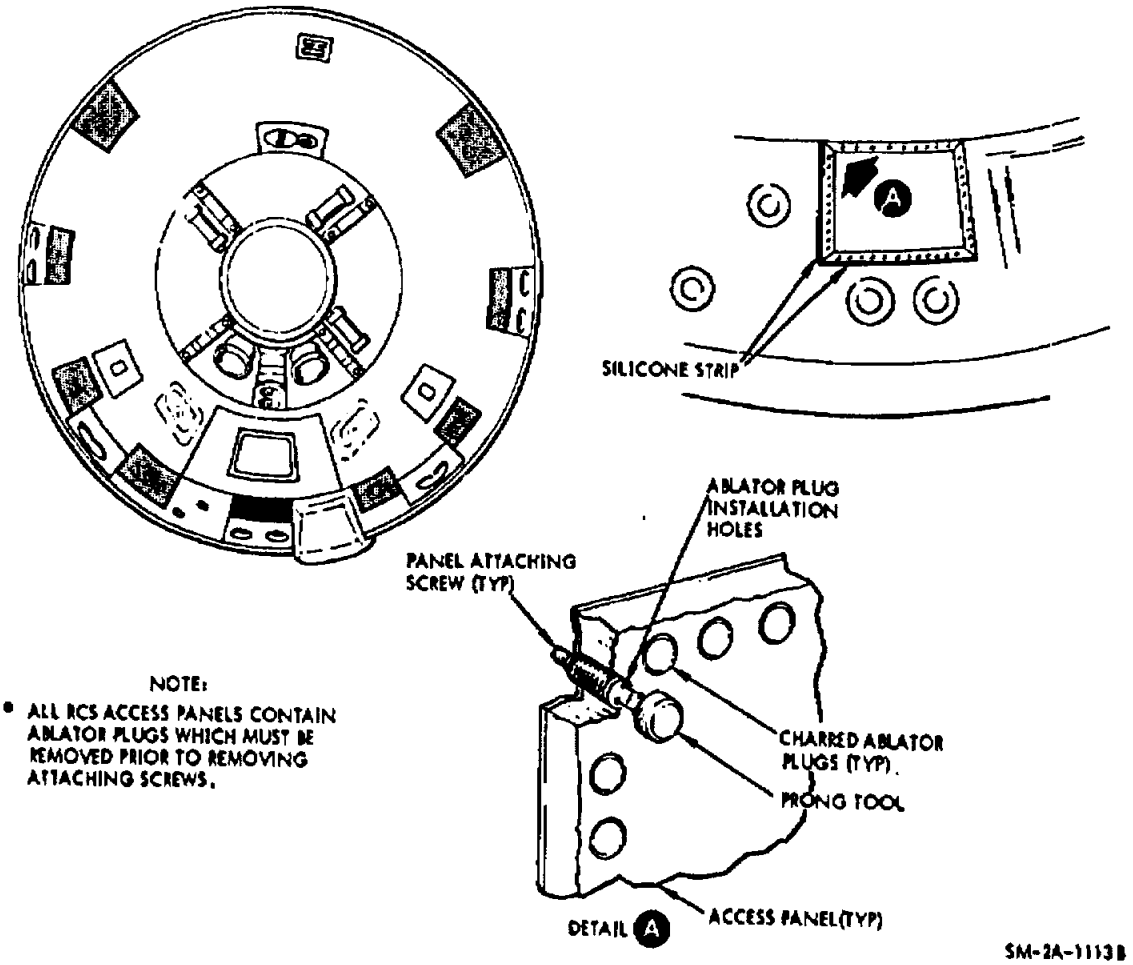


Figure 3-21. Ablator Plug Removal

3-60. INSPECTION.

3-61. Perform RCS inspection as specified in the following steps:

a. Inspect exterior RCS areas identified by figure 3-23. Utilize space provided on figure 3-24 for recording findings.

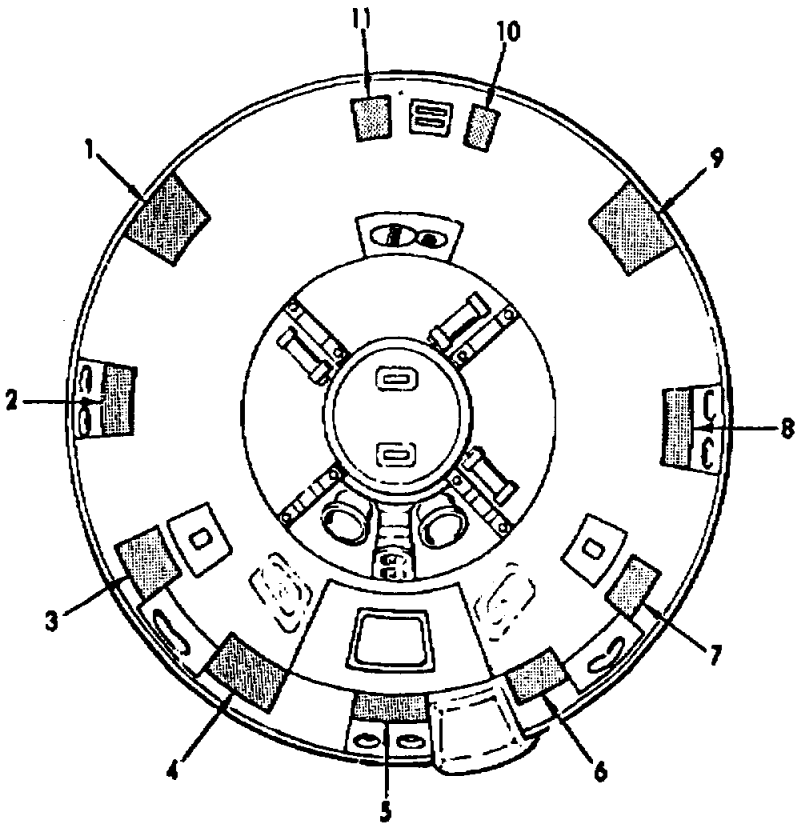
b. Following access panel removal, visually inspect RCS components for evidence of damage, leaks, irregularities, etc.

3-62. PHOTOGRAPHIC REQUIREMENTS

3-63. Photographic requirements applicable to the RCS are as follows:

a. Closeups of individual access areas.

b. Closeups of each engine.



INDEX	PANEL
1	FUEL PANEL ACCESS
2	HELIUM PANEL B AND -YAW ENGINE ACCESS
3	CCW ROLL ENGINE ACCESS
4	CW ROLL ENGINE ACCESS
5	+ PITCH ENGINES ACCESS
6	CONTROL BOX C19A1 AND CCW ROLL ENGINE ACCESS
7	CW ROLL ENGINE ACCESS
8	HELIUM PANEL A AND +YAW ENGINE ACCESS
9	OXIDIZER PANEL ACCESS
10	RH SIMULATED UMBILICAL ACCESS
11	LH SIMULATED UMBILICAL ACCESS

SM-2A-111-C

Figure 3-22. Access Panel Removal (Typical)

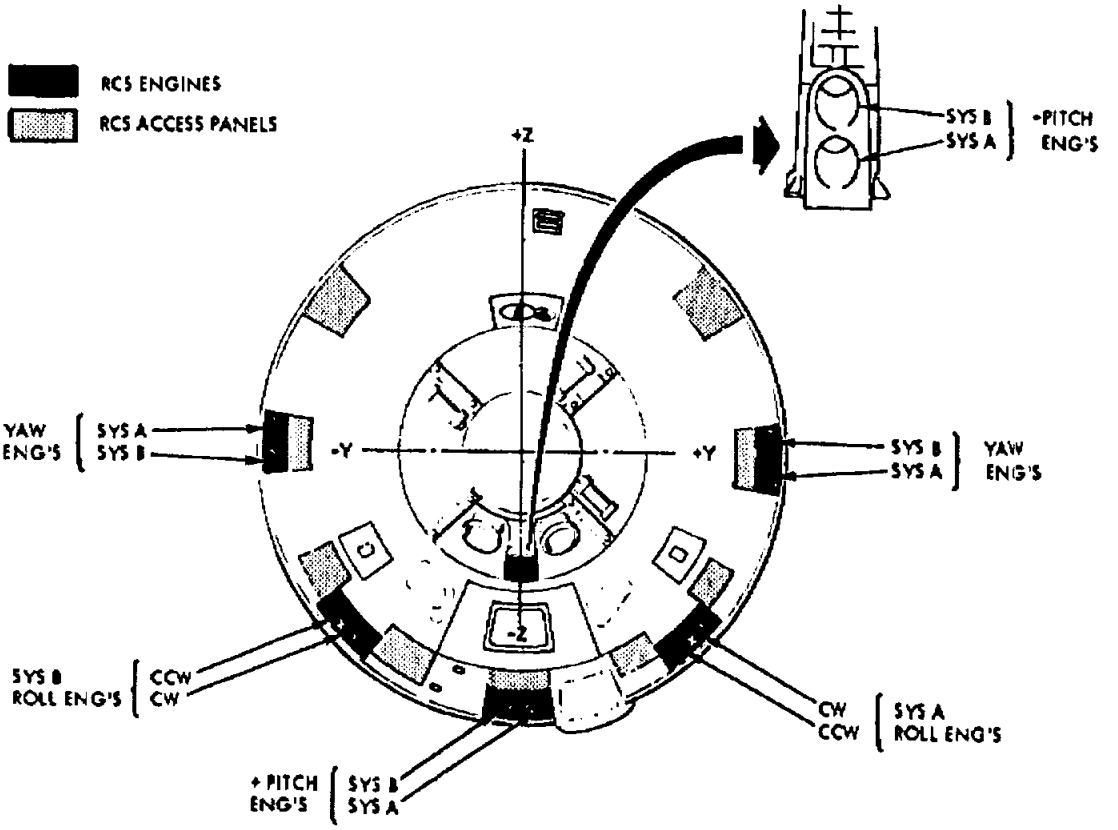


Figure 3-23. CM RCS Inspection

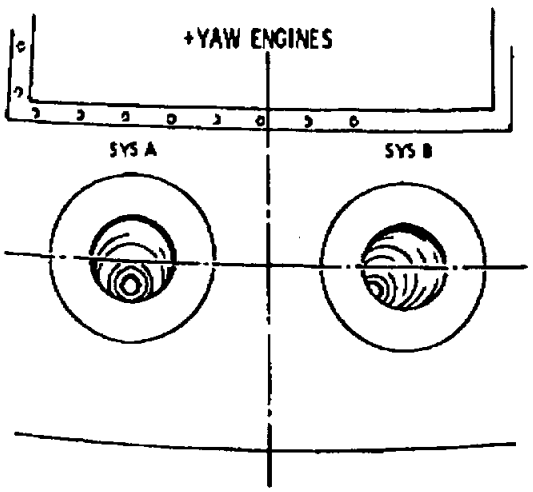
c. Closeups of any irregularities, etc.

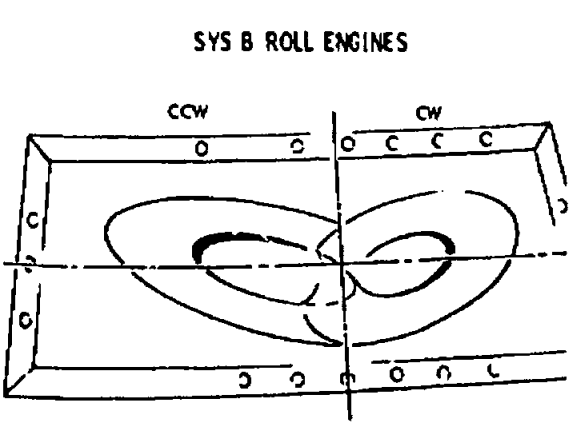
d. Closeups of pyrotechnic connectors prior to removal.

e. Closeups and general photographic coverage as directed by the NASA LST Director.

3-64. HELIUM RESIDUAL PRESSURE BLEEDING

3-65. The Apollo CM contains two RCS helium tanks. Residual helium pressure is locked in the tanks and must be bled off before deactivation procedures may be performed. Figure 3-25 shows the location of the ports utilized and identifies the couplings required to bleed helium system A and B.





REMARKS:

REMARKS:

NOTE

1. RECORD PERCENTAGE OF CHAR WITHIN EACH QUADRANT (% = NO CHAR)
2. RECORD COMMENTS RELATING CONDITION OF EXHAUST CONES, THROATS AND LINERS (NOT ALL ABNORAMALITIES AS WELL AS GENERAL CONDITION).

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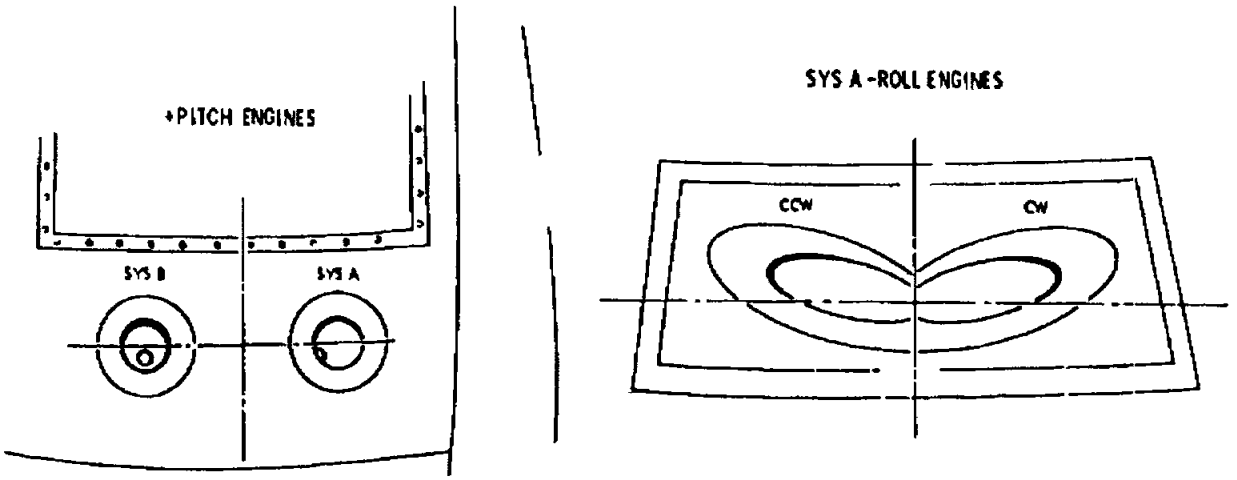
Figure 3-24. RCS Inspection (Sheet 1 of 3)



REMARKS: _____

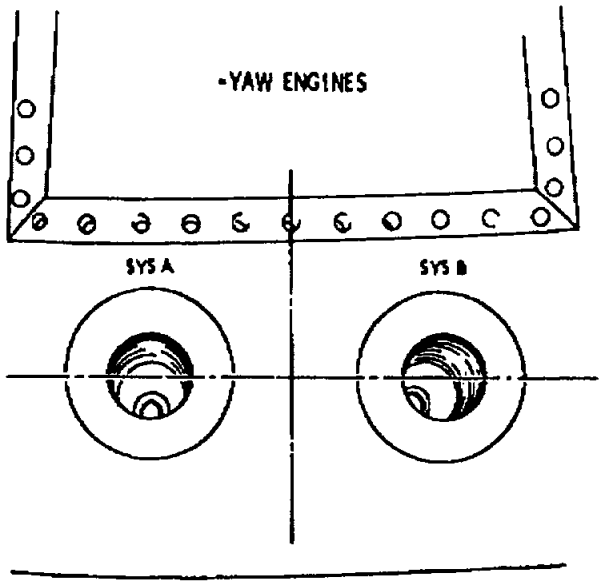
REMARKS: _____

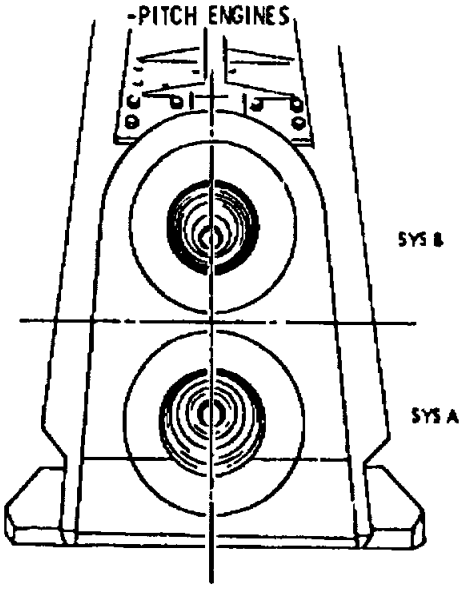
NOTE

1. RECORD PERCENTAGE OF CHAR WITHIN EACH QUADRANT (0% = NO CHAR).
2. RECORD COMMENTS RELATING CONDITION OF EXHAUST CONES, THROATS AND LINEARS (NOTE ALL ABNORAMALITIES AS WELL AS GENERAL CONDITION.

SM-2A-1191

Figure 3-24. RCS Inspection (Sheet 2 of 3)





REMARKS:

REMARKS:

NOTE

1. RECORD PERCENTAGE OF CHAR WITHIN EACH QUADRANT (0% = NO CHAR)
2. RECORD COMMENTS RELATING CONDITION OF EXHAUST CONES, THROATS AND LINERS (NOTE ALL ABNORMALITIES AS WELL AS GENERAL CONDITION.

SM-2A-1192

Figure 3-24. RCS Inspection (Sheet 3 of 3)

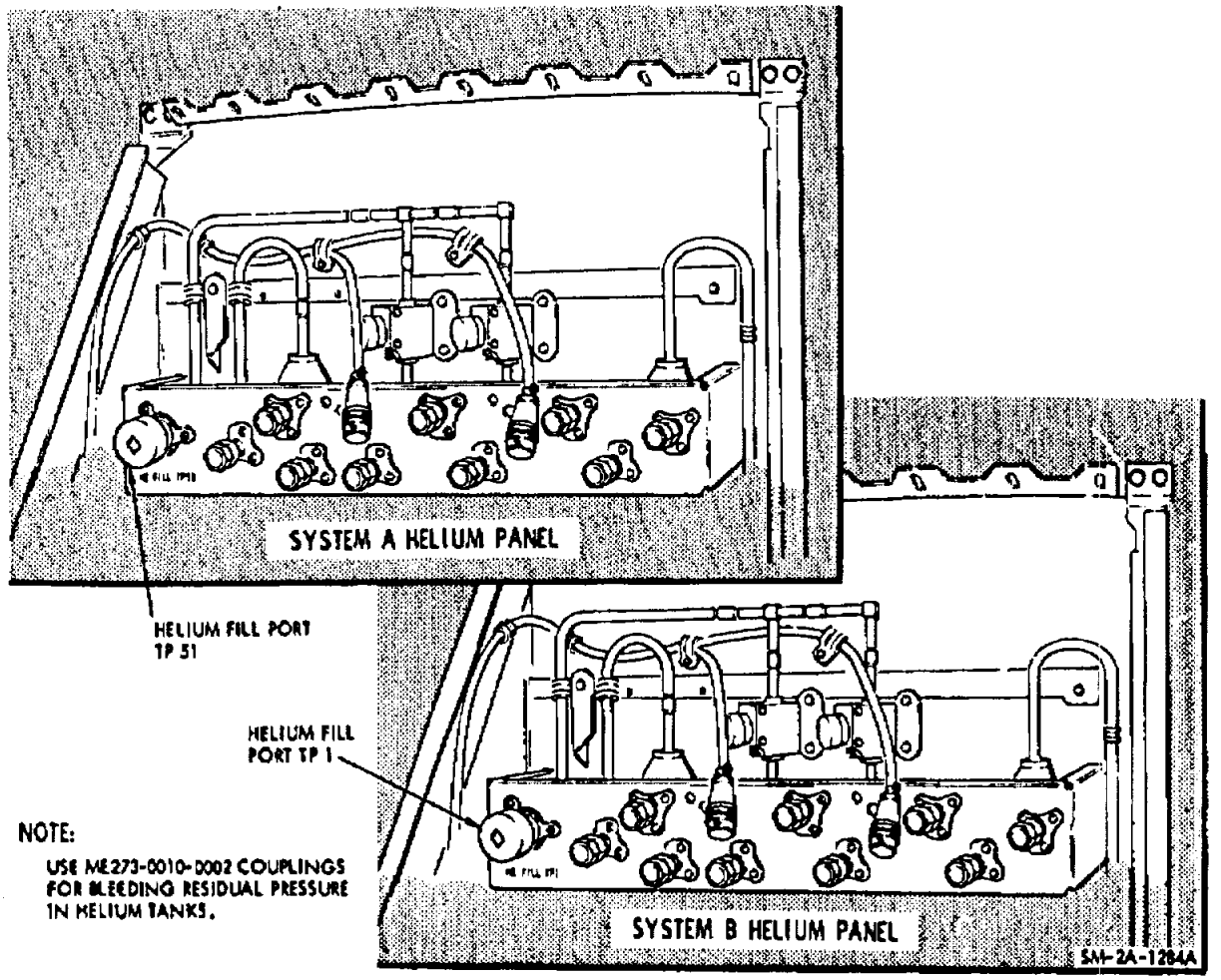

SYSTEM A HELIUM PANEL
HELIUM FILL PORT TP 51
HELIUM FILL PORT TP 1
NOTE:
USE ME273-0010-0002 COUPLINGS FOR BLEEDING RESIDUAL PRESSURE IN HELIUM TANKS.
SYSTEM B HELIUM PANEL
SM-2A-1284A

Figure 3-25. Helium Residual Pressure Bleeding

3-66. PREPARING CM ELECTRICAL SYSTEM FOR DEACTIVATION

3-67. Prior to CM RCS deactivation, and after system shutdown and pyrotechnic safing, it will be necessary to remove potting compound from several terminal boards. (See figure 3-26.)

a. On the fuel panel, terminal board C05TB20(LH), remove potting compound surrounding terminal posts 1 through 5; terminal board, C05TB20 (RH), remove potting compound surrounding terminal posts 7 through 11.

b. On the oxidizer panel, terminal board C05TB21, remove potting compound surrounding terminal posts 1 through 10.

NOTE

System A and system B isolation valve leads must be disconnected at terminal and wrapped with tape. Leads from terminal boards to valve solenoids must remain connected. (See figure 3-26, sheet 2.)

3-68. CM ELECTRICAL CABLE PLUG REMOVAL

3-69. Prior to accomplishing CM-GSE electrical interface, two plugs (C05W3P104 and C05W3P99), located within the CW and CCW roll engine access areas (figures 3-27, 3-28, and 3-29), must be disconnected to accommodate GSE cabling.

a. At CCW engine access area, disconnect plug C05W3P99 from receptacle J8 on C19A1 system A control box.

b. At CW engine access area, disconnect plug C05W3P104 from receptacle C05W7J104.

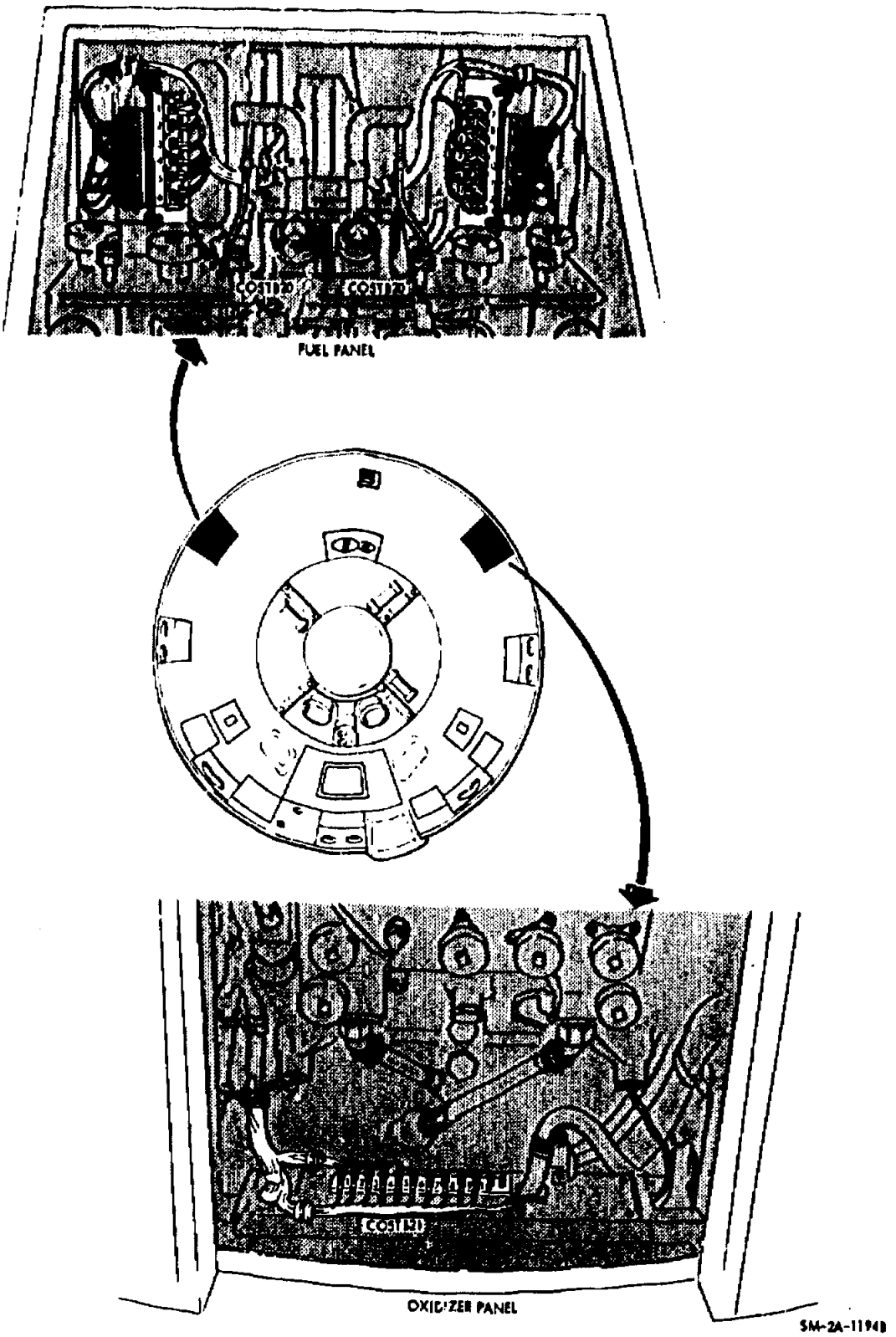


Figure 3-26. Disconnecting CM Control From Systems A and B RCS Isolation Valves (Sheet 1 of 2)

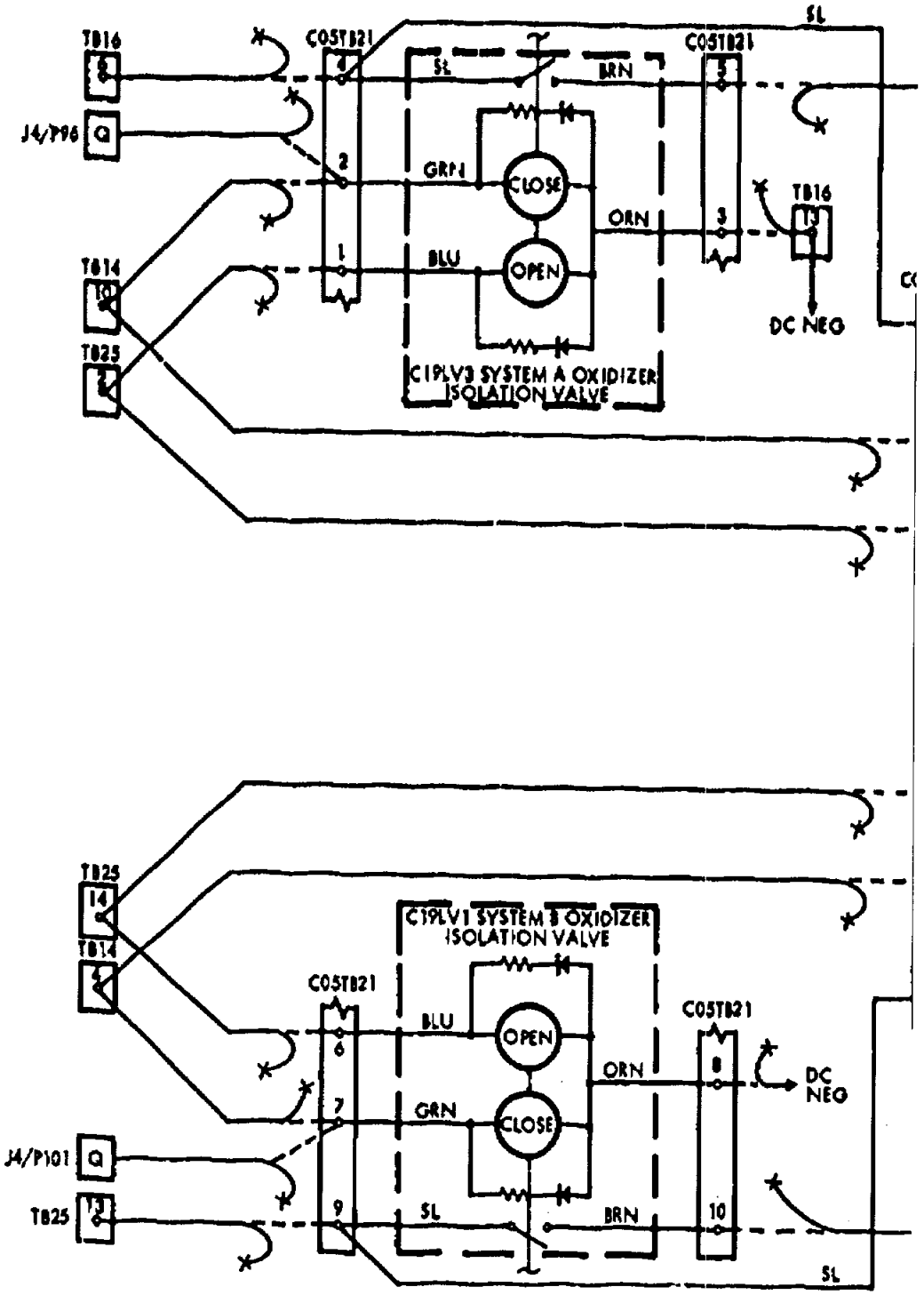


Figure 3-26. Dis
RC

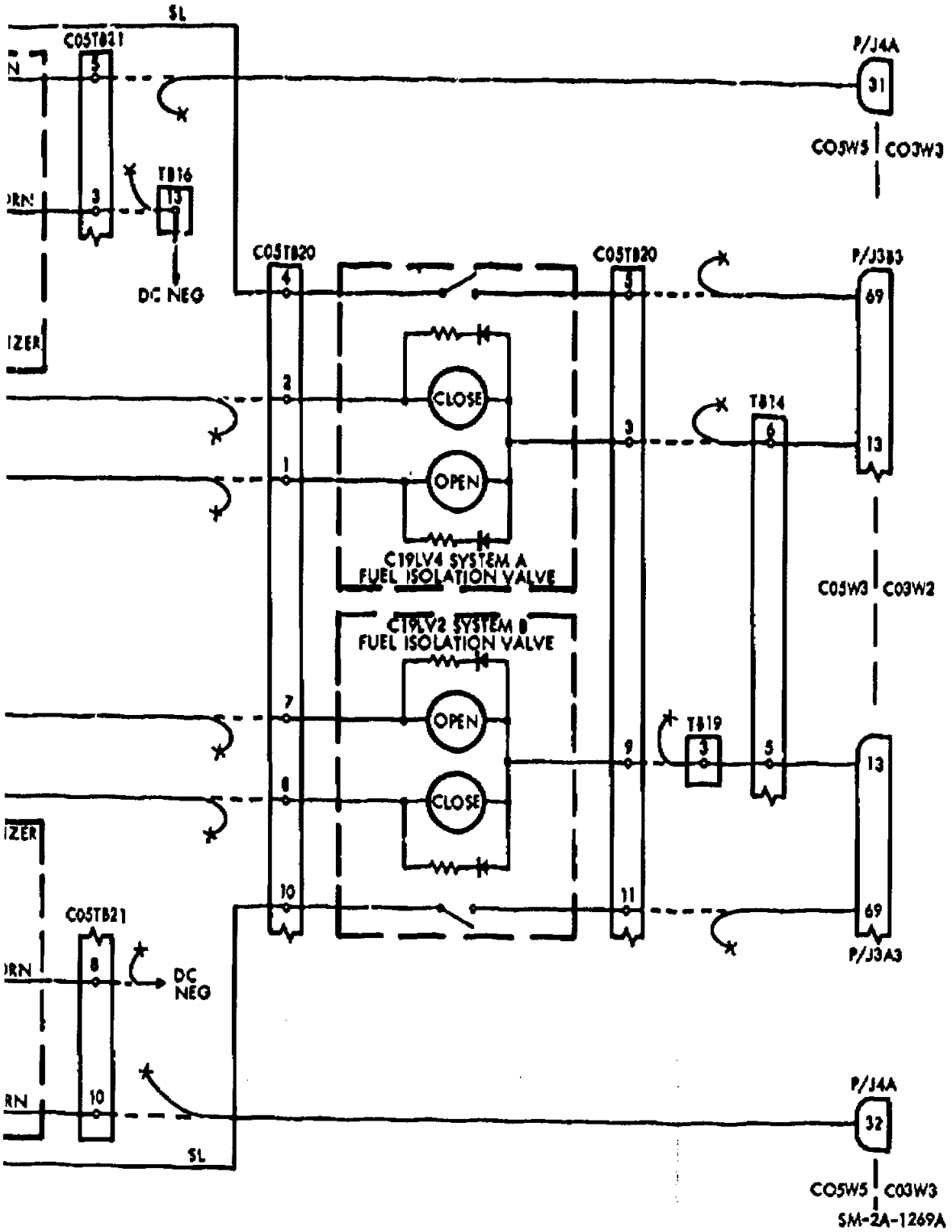


Figure 3-26. Disconnecting CM Control From Systems A and B RCS Isolation Valves (Sheet 2 of 2)

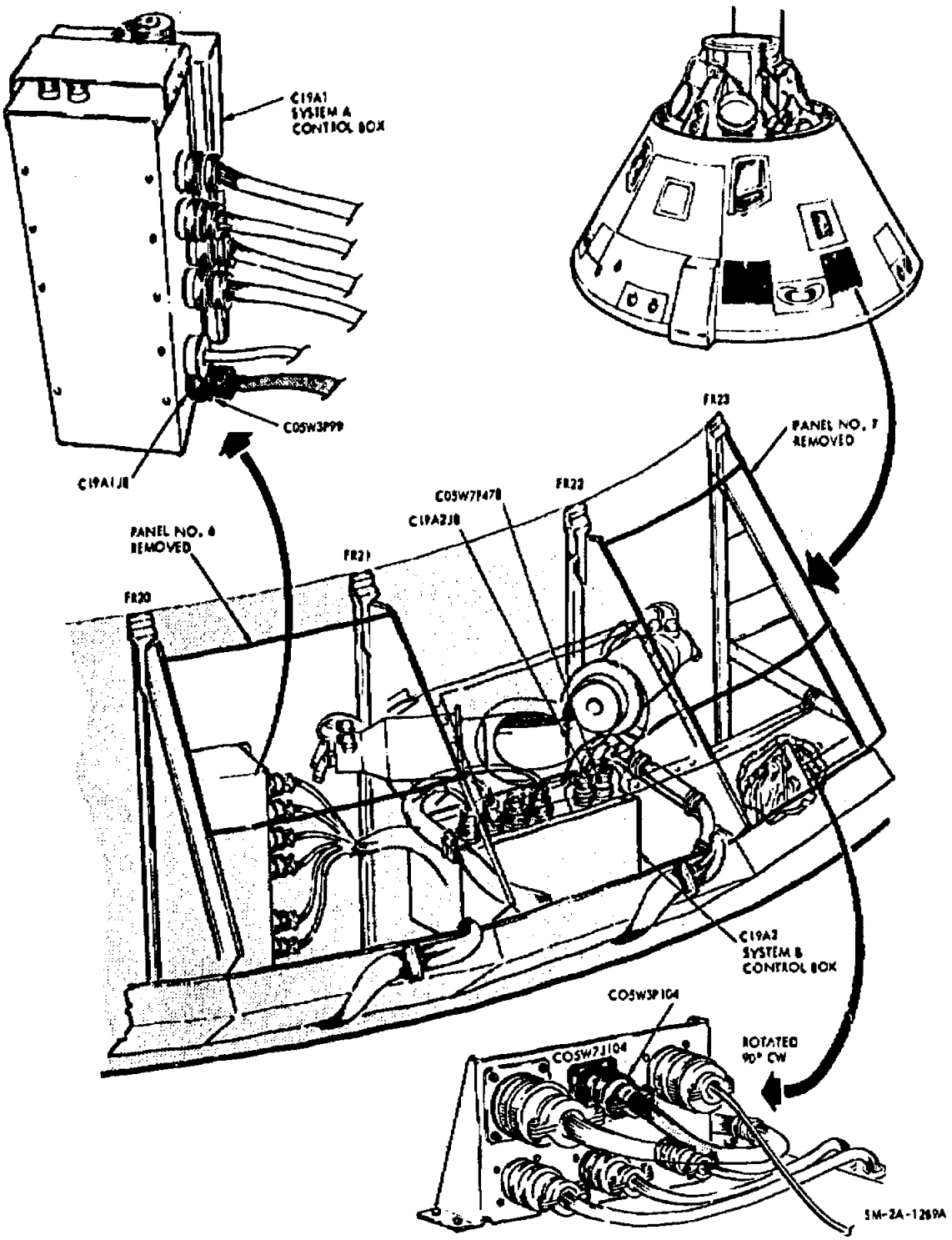
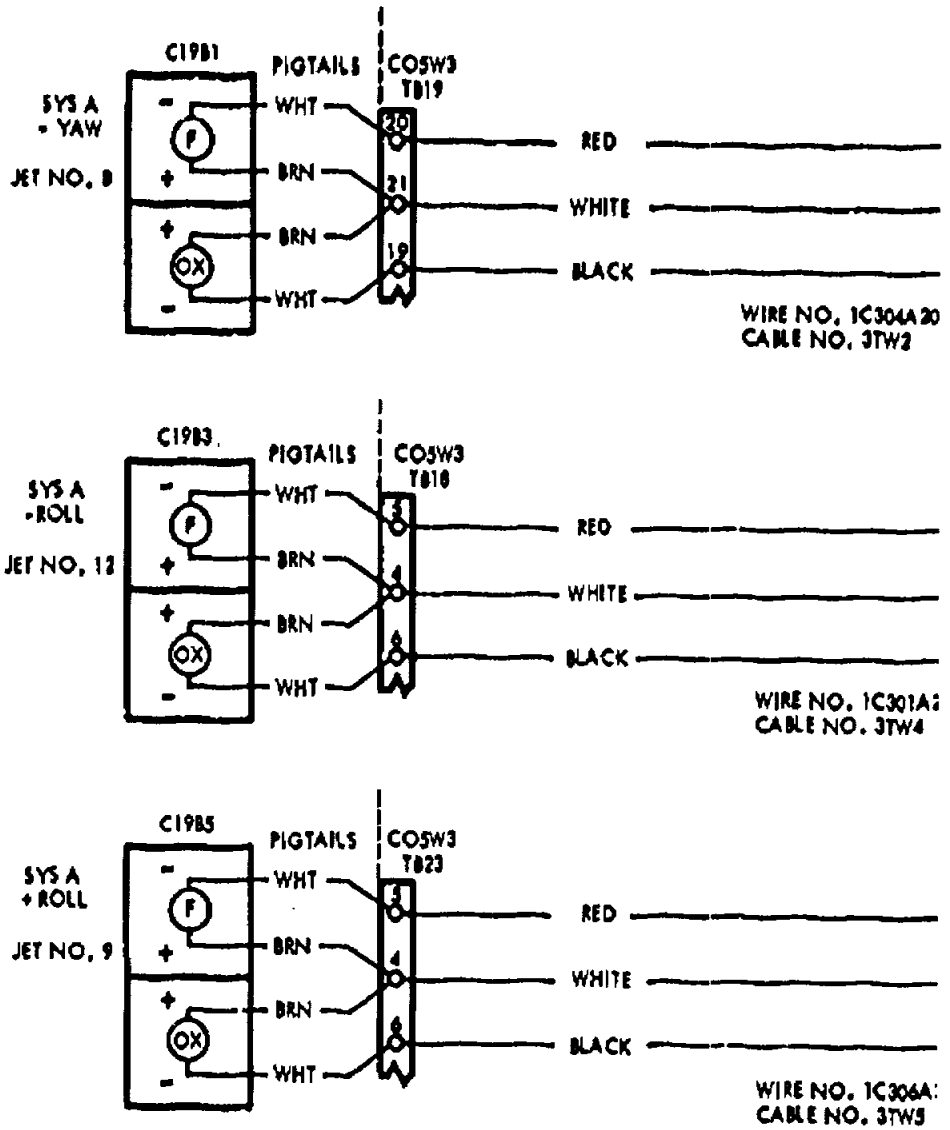


Figure 3-27. Engine Valve Electrical Plug Removal


C1981
PIGTAILS
CO5W3
TB19
SYS A
+ YAW
JET NO. 8
WHT
BRN
BRN
WHT
20
21
19
RED
WHITE
BLACK
WIRE NO. 1C304A20
CABLE NO. 3TW2
C1983
PIGTAILS
CO5W3
TB18
SYS A
+ROLL
JET NO. 12
WHT
BRN
BRN
WHT
3
4
6
RED
WHITE
BLACK
WIRE NO. 1C301A3
CABLE NO. 3TW4
C1985
PIGTAILS
CO5W3
TB23
SYS A
+ ROLL
JET NO. 9
WHT
BRN
BRN
WHT
3
4
6
RED
WHITE
BLACK
WIRE NO. 1C306A3
CABLE NO. 3TW5

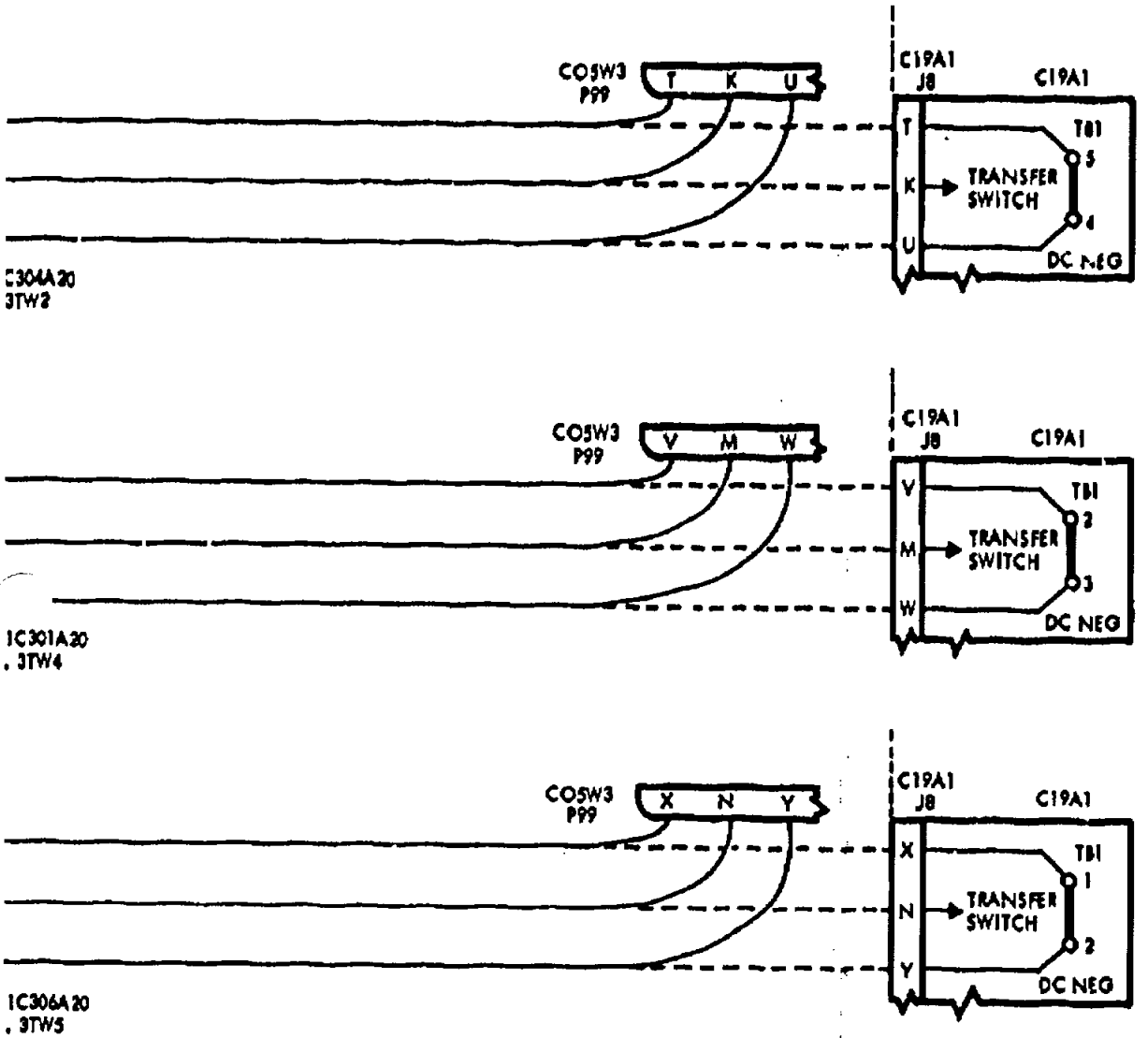
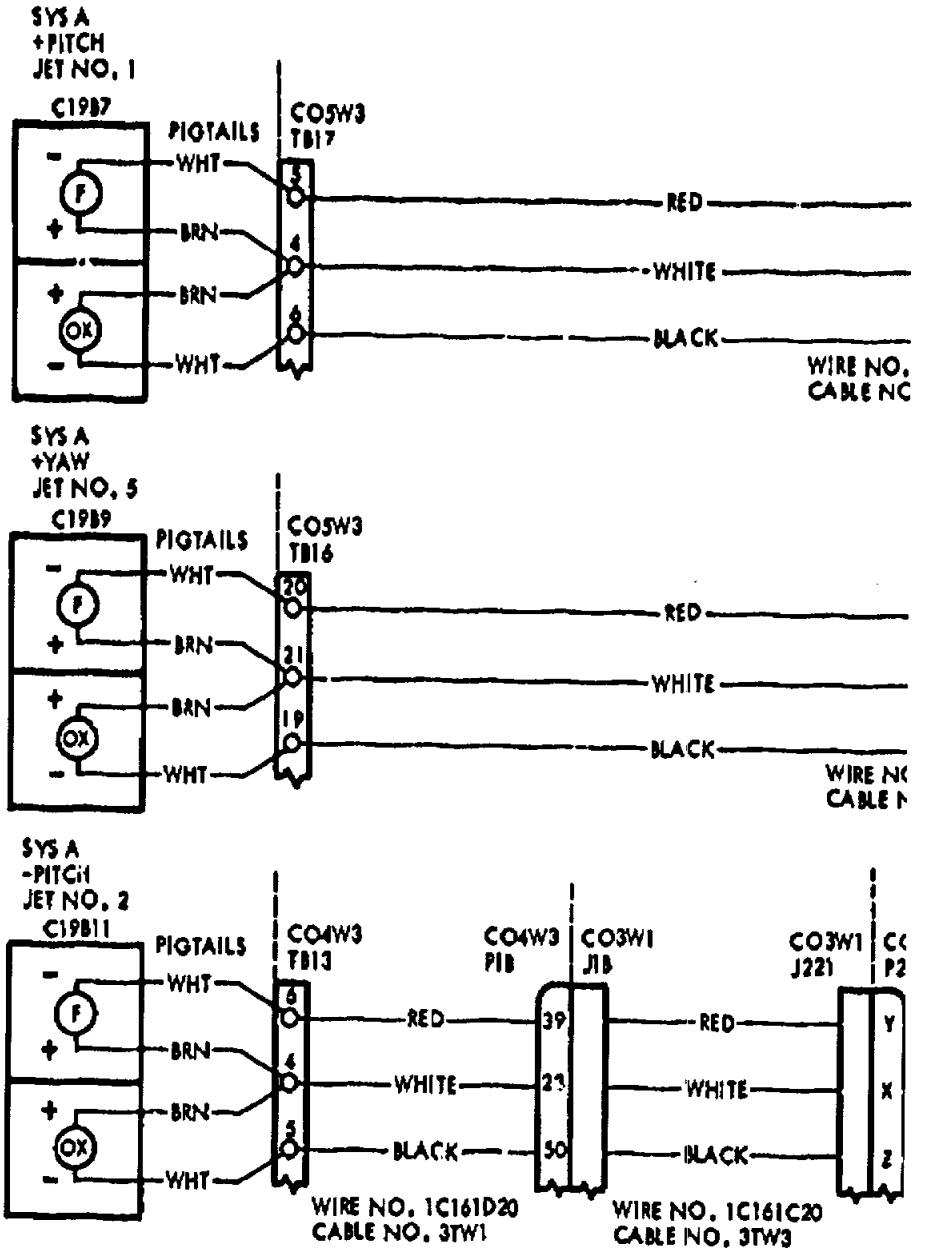


Figure 3-28. Disconnecting CM Control From System A RCS Engine Valves (Sheet 1 of 2)


SYS A
+PITCH
JET NO. 1
C19B7
PIGTAILS
WHT
BRN
BRN
WHT
C05W3
TB17
3
4
6
RED
WHITE
BLACK
WIRE NO.
CABLE NC
SYS A
+YAW
JET NO. 5
C19B9
PIGTAILS
WHT
BRN
BRN
WHT
C05W3
TB16
20
21
19
RED
WHITE
BLACK
WIRE NC
CABLE N
SYS A
-PITCH
JET NO. 2
C19B11
PIGTAILS
WHT
BRN
BRN
WHT
C04W3
TB13
6
4
5
RED
WHITE
BLACK
C04W3
P18
39
23
50
C03W1
J18
RED
WHITE
BLACK
C03W1
J221
Y
X
Z
C(
P2
WIRE NO. 1C161D20
CABLE NO. 3TW1
WIRE NO. 1C161C20
CABLE NO. 3TW3

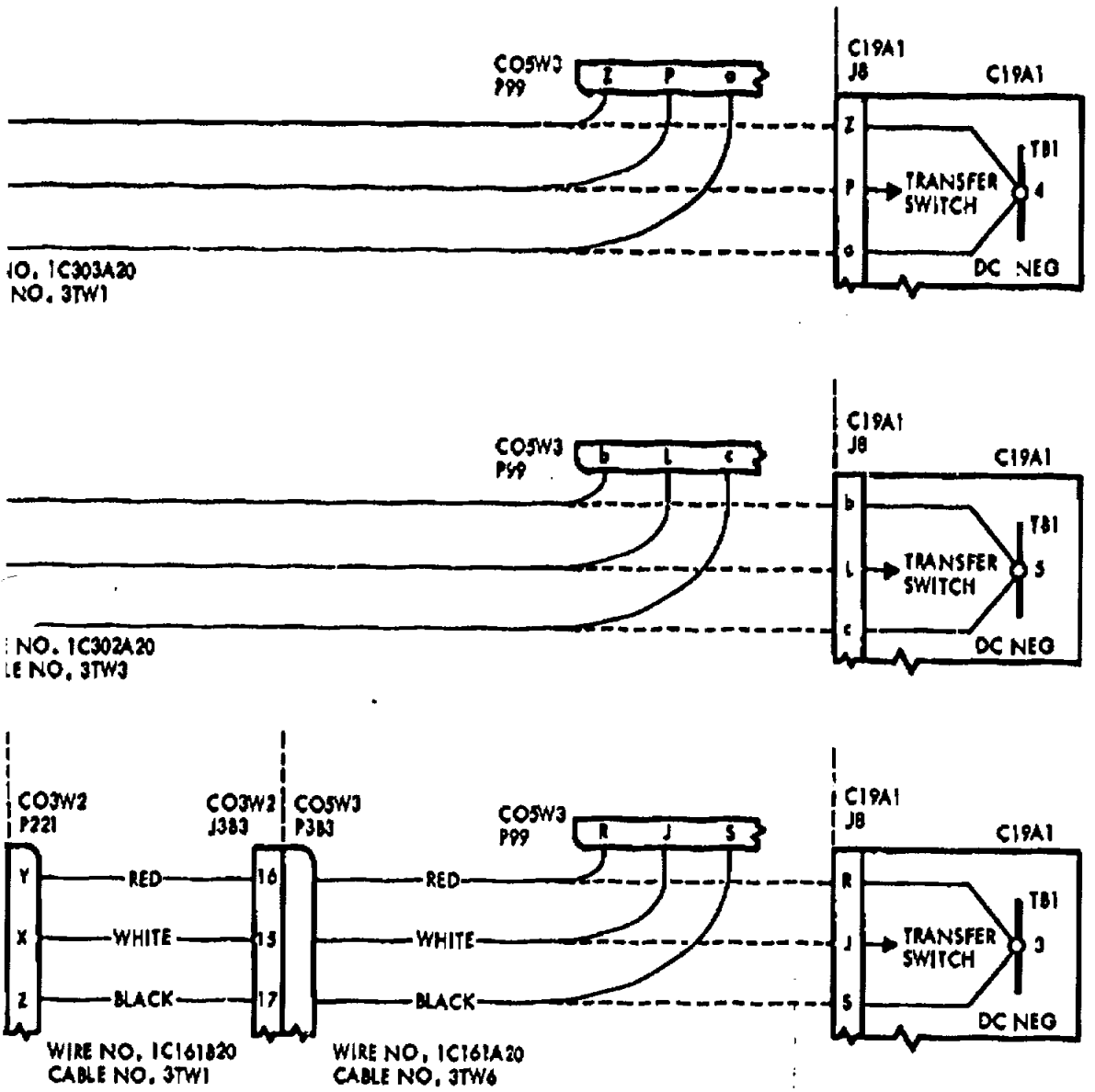


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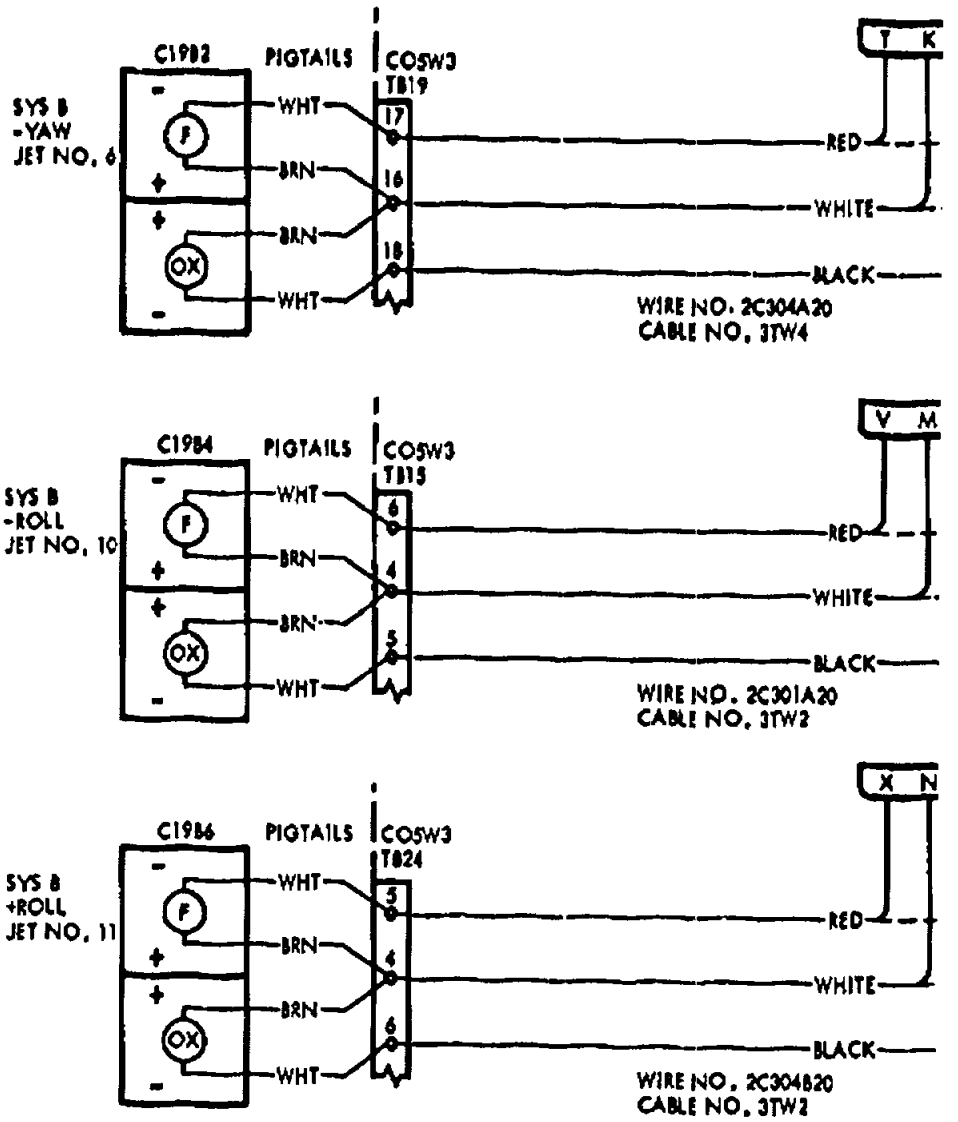
Figure 3-28. Disconnecting CM Control From System A RCS Engine Valves (Sheet 2 of 2)


C1982
PIGTAILS
CO5W3
TB19
SYS B
-YAW
JET NO. 6
F
OX
WHT
BRN
BRN
WHT
17
16
18
T
K
RED
WHITE
BLACK
WIRE NO. 2C304A20
CABLE NO. 3TW4
C1984
PIGTAILS
CO5W3
TB15
SYS B
-ROLL
JET NO. 10
F
OX
WHT
BRN
BRN
WHT
6
4
5
V
M
RED
WHITE
BLACK
WIRE NO. 2C301A20
CABLE NO. 3TW2
C1986
PIGTAILS
CO5W3
TB24
SYS B
+ROLL
JET NO. 11
F
OX
WHT
BRN
BRN
WHT
5
4
6
X
N
RED
WHITE
BLACK
WIRE NO. 2C304B20
CABLE NO. 3TW2

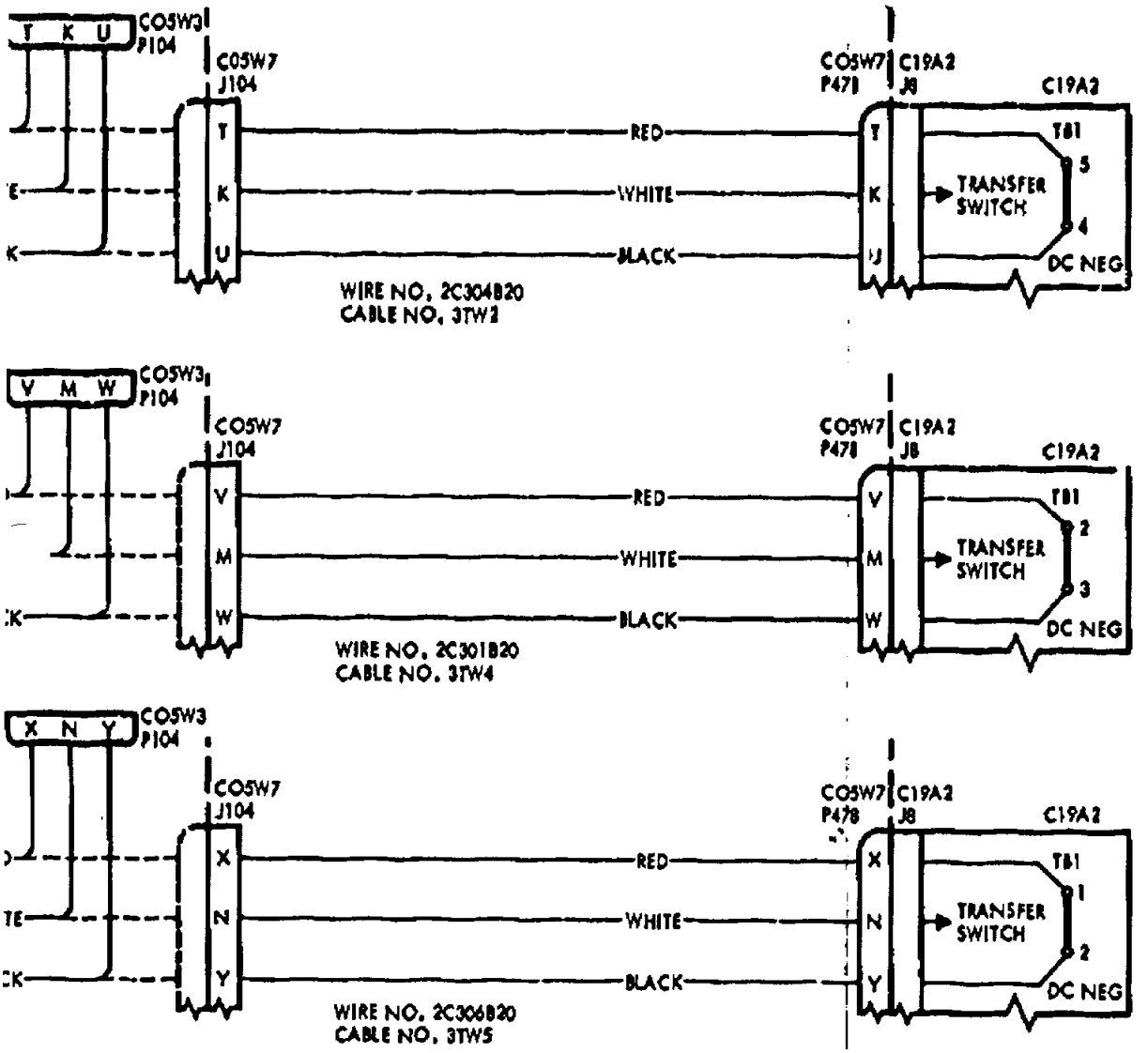
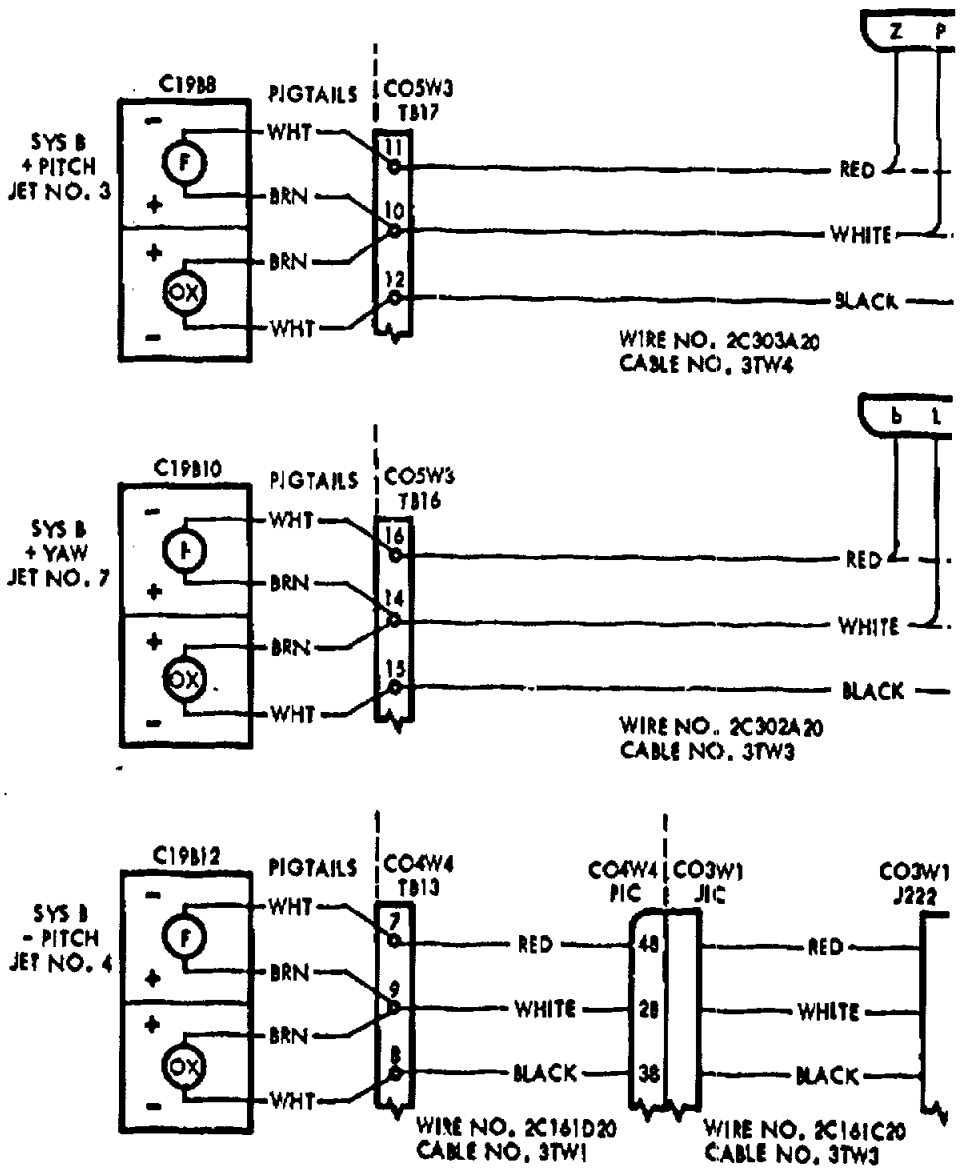


Figure 3-29. Disconnecting CM Control From System B RCS Engine Valves (Sheet 1 of 2)


C19B8
PIGTAILS
C05W3
TB17
SYS B
+ PITCH
JET NO. 3
WHT
BRN
BRN
WHT
11
10
12
RED
WHITE
BLACK
Z
P
WIRE NO. 2C303A20
CABLE NO. 3TW4
C19B10
PIGTAILS
C05W3
TB16
SYS B
+ YAW
JET NO. 7
WHT
BRN
BRN
WHT
16
14
15
RED
WHITE
BLACK
b
L
WIRE NO. 2C302A20
CABLE NO. 3TW3
C19B12
PIGTAILS
C04W4
TB13
SYS B
- PITCH
JET NO. 4
WHT
BRN
BRN
WHT
7
9
8
RED
WHITE
BLACK
C04W4
P1C
C03W1
J1C
C03W1
J222
48
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WHITE
BLACK
WIRE NO. 2C161D20
CABLE NO. 3TW1
WIRE NO. 2C161C20
CABLE NO. 3TW3

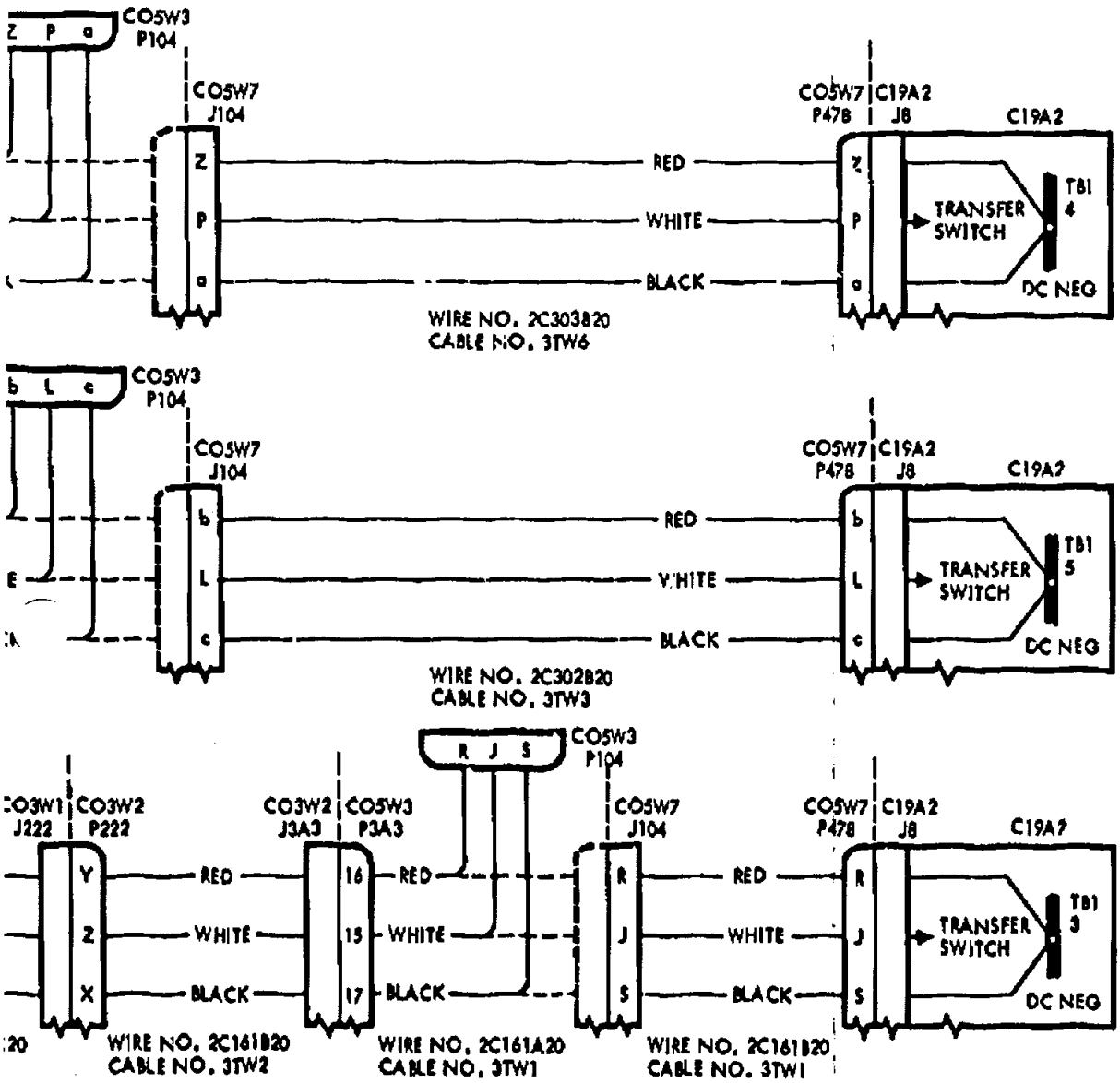


Figure 3-29. Disconnecting CM Control From System B RCS Engine Valves (Sheet 2 of 2)

SECTION IV

FUEL SYSTEM DEACTIVATION PROCEDURES FOR NORMAL MISSION OR HIGH-ALTITUDE ABORT

4-1. GENERAL

4-2. This section provides the procedures required to deactivate and prepare the fuel side of the CM-RCS for return shipment to the Contractor's facility. Procedural data, as presented in this section is applicable only to normal or high-altitude abort conditions. Information relative to fuel system deactivation, following a pad or low-altitude abort, may be found in section VI.

4-3. CM-GSE ELECTRICAL INTERFACE—S14-137

4-4. For fuel system deactivation electrical hookup, see figure 9-1 and proceed as follows:

a. On S14-137, connect receptacle W4J1 of cable W4 (G16-848786) to plug P99 of CM C05W3 wiring harness (removed from J8 on C19A1 RCS control box).

b. Verify that plug W4P1 of cable W4 is connected to SYSTEM A ENGINE VALVES receptacle (A3J3) on S14-137.

c. On S14-137, connect receptacle W5J1 of cable W5 (G16-880569-51) to plug P104 of CM C05W3 wiring harness (removed from J104 on CM C05W7 wiring harness.

d. Verify that plug W5P1 of cable W5 is connected to SYSTEM B ENGINE VALVES receptacle (A3J4) on S14-137.

e. On S14-137, connect cable W3 (G16-848797-21) to CM terminal board C05TB20 as indicated in figures 9-1 and 9-2.

f. Verify that plug W3P1 of cable W3 is connected to FUEL ISOLATION VALVES receptacle (A3J2) on S14-137.

NOTE

If 115-vac 60-cps facility power is not available at interim port, use battery sources supplied with S14-137 deactivation unit.

g. Verify that plug W2P2 of cable W2 (G16-848798-11) is connected to AC POWER receptacle (A3J1) on S14-137.

h. Verify that plug W2P1 of cable W2 is connected to receptacle W1J1 of cable W1 (G16-848798-21).

i. Connect plug W1P1 of cable W1 to facility 115-vac 60-cps power.

4-5. CM-GSE FLUID LINE INTERFACE—S14-137

4-6. For fuel system deactivation fluid line hookup (normal mission), see figures 2-16 and 4-1, and proceed as follows:

CAUTION

When handling flex lines, use care to prevent kinking.

a. Verify G4FH6 hose assembly (95625) is connected to RCS FUEL CHECK VALVES—HELIUM PANEL port on S14-137.

b. Connect G4MD1 coupling (ME144-0023-0041) of G4FH6 to helium check valve port (TP8) on system B helium panel of CM.

c. Connect G4MD2 coupling (ME144-0023-0041) of G4FH6 to helium check valve port (TP58) on system A helium panel of CM.

d. Verify G42FH1 hose assembly (95578) is connected to RCS FUEL VENT port on S14-137.

e. Connect G42MD1 coupling (ME273-0024-0002) of G42FH1 to system B HE VENT port (TP15) on RCS fuel panel of CM.

f. Connect G42MD2 coupling (ME273-0024-0002) of G42FH1 to system A HE VENT port (TP65) on RCS fuel panel of CM.

g. Verify G42FH2 hose assembly (95580) is connected to FUEL LIQUID SIDE VENT port on S14-137.

h. Connect G42MD3 coupling (ME273-0021-0002) of G42FH2 to system B FUEL LIQ VENT port (TP23) on RCS fuel panel of CM.

i. Obtain a sample of flushing fluid (alcohol) within flushing tank (G42TK1) by accomplishing the following steps:

1. Disconnect G42MD9 coupling from G42FH2 hose assembly.

2. Open G42MV1.

3. Position suitable container for securing sample.

4. Open K-bottles and crack G4PR1 until fluid flows from open end of G42FH2 hose assembly.

5. When sample has been taken, close G4PR1, K-bottles, and G42MV1.

6. Re-install G42MD9 coupling.

7. Store sample; then forward to predesignated test facility for analysis with sample obtained in paragraph 4-18, step u.

j. Connect G42MD4 coupling (ME273-0021-0002) of G42FH2 to system A FUEL LIQ VENT port (TP73) on RCS fuel panel of CM.

NOTE

Verify G42MD9 coupling (ME273-0024-0002) and G16-848811-3 hose assembly are connected to 8R6BX-SS tee.

k. Verify G42FH3 hose assembly (G16-848826-3) is connected to TEST POINTS FUEL PANEL port on S14-137.

l. Connect G42MD5 coupling (ME144-0023-0041) of G42FH3 to system B test port (TP19) on RCS fuel panel of CM.

m. Connect G42MD6 coupling (ME144-0023-0041) of G42FH3 to system A test port (TP69) on RCS fuel panel of CM.

n. Verify G42FH4 hose assembly (95580) is connected to RCS FUEL FILL port on S14-137.

o. Verify flex hoses of G42MD7 and G42MD8 couplings are connected to G42FH4.

p. Connect G42MD7 coupling (ME273-0021-0002) of G42FH4 to system B FUEL FILL port (TP17) on RCS fuel panel of CM.

q. Connect G42MD8 coupling (ME273-0021-0002) of G42FH4 to system A FUEL FILL port (TP67) on RCS fuel panel of CM.

r. Verify G42FH5 hose assembly (G16-848824-3) is connected to RCS ENGINES port on S14-137.

s. Verify G42FH6 hose assembly (G16-848825-3) is connected to G42FH5 hose assembly (G16-848824-3).

t. See figures 3-13 and 9-5, and install A14-179 adapters in the 12 RCS engines.

u. Connect A14-179 adapters (12) to parallel links of G42FH6 hose assembly.

v. Verify G45FH1 hose assembly (G16-848821-3) is connected to VENT port on S14-137.

w. Connect both G16-848821-7 flex hose extensions and unions to G16-848821-3 hose assembly. (See figure 2-16.)

4-7. EXPULSION OF USABLE PROPELLANTS

4-8. The purpose of this procedure is to measure the amount of usable propellant (fuel) remaining after a normal mission or high-altitude abort. Propellant expulsion is accomplished by compressing the teflon bladders (systems A and B), thereby expelling usable propellant into the collector tank.

4-9. EXPULSION PROCEDURES. To expel usable propellants from the bladders, proceed as follows:

NOTE

- Verify electrical interface and fluid line interface have been accomplished per paragraphs 4-3 and 4-5.
- Prior to proceeding further, unfold figure 4-1.

Step	Location	Instructions	Remarks
a	S14-137 (RCS POWER CONTROL panel)	Perform the following steps: NOTE If 115-vac 60-cps facility power is not available, leave 115 VAC-ON-OFF switch at OFF and set 28 VDC-BATTERY SUPPLY-CHARGE switch to BATTERY SUPPLY.	

Step	Location	Instructions	Remarks
		1. Verify VACUUM PUMP switch at OFF.	
		2. Set AC-DC EMERGENCY CONTROL switch to on (up).	
		3. Set 28 VDC-POWER SUPPLY-CHARGE switch to POWER SUPPLY.	
		4. Set 115 VAC-ON-OFF switch to ON; verify 115 VAC ON indicator lamp is lighted.	
		CAUTION	
	S14-137 (RCS VALVE CONTROL panel)	• In case of an engine valve failure (engine valve HOLD OPEN indicator lamp lights), close systems A and B isolation valves as follows:	
		• Set systems A and B isolation valve reset switches to RESET.	
		• Momentarily hold systems A and B ISOLATION VALVE switches to CLOSE. Verify CLOSED indicator lamps are lighted.	
		5. Verify system A and system B isolation valves (LV2 and LV4) are open.	
		6. Verify switches C19B1 through C19B12 in CLOSE position. (Engine fuel valves closed.)	

Step	Location	Instructions	Remarks
b	CM RCS (fuel panel)	Verify the following squib valve positions: 1. Helium interconnect open. 2. Helium dump closed. 3. He-fuel bypass (2) open. 4. Fuel interconnect open. CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs.)	
c	CM-RCS (fuel panel)	Crimp lines in close proximity to explosive helium bypass valves (He-FUEL BYPASS) to isolate fuel side of system from helium side. (See figure 4-2.) NOTE If explosive bypass valves have failed to fire, crimping will not be necessary.	
d	S14-137 (PRESSURE panel)	Verify the following valves are set at full decrease: 1. ALCOHOL TANK PRESSURE REGULATOR (G4PR1) 2. NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
e	S14-137	Open K-bottle valves (5).	
f	S14-137 (PRESSURE panel)	Verify NITROGEN SUPPLY gauge (G4PG1) indicates 1500 psig minimum.	

Step	Location	Instructions	Remarks
g	S14-137 (on top of scrubber tank)	Open G45MV2.	
h	CM-RCS (sys A He panel)	Open TP58.	
i	CM-RCS (sys B, He panel)	Open TP8.	
j	CM-RCS (fuel panel)	Open TP17 and TP67.	
k	S14-137 (VENT panel)	Open the following valves: 1. FROM RCS FILL (G42MV5) 2. FROM LIQUID SIDE VENT (G42MV6).	
l	S14-137 (PRESSURE panel)	Open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 10 (+0, -5) psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
m	S14-137 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 40±2 psig, as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
n	S14-137 (PRESSURE panel)	Note and record pressure indication on RCS FILL gauge (G42PG1). Record: _____	

Step	Location	Instructions	Remarks
o	S14-137	Open the following valves: 1. G34MV2 2. G34MV4.	
p	S14-137 (PRESSURE panel)	When RCS FILL gauge (G42PG1) reads 0 (+2, -0) psig, perform the following:	
	S14-137 (VENT panel)	1. Close the following valves: (a) FROM RCS FILL (G42MV5) (b) FROM RCS LIQUID SIDE VENT (G42MV6).	
	CM-RCS (fuel panel)	2. Close TP17 and TP67.	
q	CM-RCS (fuel panel)	Open TP15 and TP65; allow pressure to stabilize at 40 psig as indicated on RCS VENT gauge (G4PG4).	
r	S14-137 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
s	S14-137 (PRESSURE panel)	After a minimum of 60 seconds, close NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and reduce pressure at TP15 and TP65 to 0 (+2, -0) psig, as indicated on RCS VENT gauge (G4PG4).	

Step	Location	Instructions	Remarks
t	S14-137 (collector tank)	Record amount of propellant (fuel) within collector tank as shown on sight gauge. Record: _____ gallons	
u	CM-RCS (sys A, He panel)	Close TP58.	
v	CM-RCS (sys B, He panel)	Close TP8.	
w	CM-RCS (fuel panel)	Close TP15 and TP65.	
x	S14-137	Close G34MV4.	

4-9A. FUEL BLADDER LEAK-CHECK

NOTE

Compliance with the fuel bladder leak-check procedures shall be determined by the NASA LST Director.

4-9B. The purpose of this procedure is to re-inflate the fuel bladders, as well as check for leaks. Nitrogen pressure is applied to the bladders and a leak tester is used to measure the displaced water in a manometer for a rate of leakage.

4-9C. LEAK-CHECK PROCEDURES. To accomplish the fuel bladder leak-check, proceed as follows:

Step	Location	Instructions	Remarks
		CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs.)	
a	CM-RCS (fuel panel)	Crimp helium line in close proximity to systems A and B helium interconnect squib valve (He INTERCONNECT) to isolate helium systems. (See figures 4-1 and 4-2.) NOTE If explosive interconnect valve has failed to fire, crimping will not be necessary.	
b	S14-137	Provide a leak-test setup by connecting a suitable length of tubing (tygon) to sampling valve (G42MV4). Attach free end of tubing to test pan. (Refer to "Leak Tester Setup" in paragraph 2-18A.)	

Step	Location	Instructions	Remarks
c	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
d	CM-RCS (fuel panel)	Open TP23 and TP73.	
e	S14-137 (PRESSURE panel)	Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), pressurize system to 8±2 psig as indicated on RCS FILL gauge (G42PG1).	
f	CM-RCS (fuel panel)	Open TP65. Take reading of water level on manometer at start of test. Record reading on space provided in step h.	
g	S14-137	Open G42MV4 (sampling valve) and begin 15-minute time check.	
h	Leak tester	After 15±0, 2 minutes, record final water level on manometer and determine water level droppage across expulsion bladder of system A fuel tank. RECORD: Sys A start level: _____ cc Sys A final level: _____ cc Sys A leakage: _____ cc	
i	CM-RCS (fuel panel)	Close TP65.	
j	S14-137	Close G42MV4 (sampling valve). NOTE If necessary, refill bubble manometer with water.	
k	CM-RCS (fuel panel)	Open TP15. Take reading of water level on manometer at start of test. Record reading on space provided in step m.	

Step	Location	Instructions	Remarks
l	S14-137	Open G42MV4 (sampling valve) and begin 15-minute time check.	
m	Leak tester	After 15±0.2 minutes, record final water level on manometer and determine water level droppage across expulsion bladder of system B fuel tank. RECORD: Sys B start level: _____ cc Sys B final level: _____ cc Sys B leakage _____ cc	
n	CM-RCS (fuel panel)	Close TP15.	
o	S14-137	Close G42MV3.	
p	S14-137	Close G42MV4 and remove leak tester.	

4-9D. ENGINE FUEL LEAK-CHECK

NOTE

Compliance with the engine fuel leak-check procedures shall be determined by the NASA LST Director.

4-9E. The purpose of this procedure is to check the engine fuel injector valves for leakage by applying pressurized nitrogen (40±2 psig) to the back-side of each valve.

4-9F. LEAK-CHECK PROCEDURES. To accomplish the fuel injector valve leak-check, proceed as follows:

Step	Location	Instructions	Remarks
a	CM-RCS	Verify A14-179 nozzle adapter installed in each nozzle engine, but disconnect parallel links of G42FH6 hose assembly. 1. Sys A +yaw 2. Sys B +yaw 3. Sys A CW 4. Sys A CCW 5. Sys A +pitch 6. Sys B +pitch 7. Sys A -pitch 8. Sys B -pitch 9. Sys B CW 10. Sys B CCW 11. Sys A -yaw 12. Sys B -yaw	
b	CM-RCS	Provide a leak-test setup by connecting a suitable length of hose (tygon) to each nozzle adapter installed in systems A and B +yaw engines. Attach free end of each hose to test pan. (Refer to "Leak Tester Setup" in paragraph 2-18A.)	

Step	Location	Instructions	Remarks
c	Leak tester	Take readings of water level on manometer at start of test. Record readings on spaces provided in step h.	
d	S14-137 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3). NOTE Isolation valves LV2 and LV4 should already be open following a normal mission or high-altitude abort.	
e	Leak tester	Begin 10-minute time check.	
f	Leak tester	After 10±0.2 minutes, read final water level on manometers and determine water level droppage across system A and system B +yaw engine fuel injector valves. Record findings on spaces provided in step h.	
g	Leak tester	Remove leak-test setup from systems A and B +yaw engines. NOTE If necessary, refill bubble manometer with water.	

Step	Location	Instructions	Remarks
h	Leak tester	Provide a leak-test setup for all remaining RCS engine fuel injector valves and repeat steps c, e and f for each pair of engines in the following sequence: RECORD: Sys A +Y start level: _____ cc Sys A +Y final level: _____ cc Sys A +Y leakage: _____ cc Sys B +Y start level: _____ cc Sys B +Y final level: _____ cc Sys B +Y leakage: _____ cc RECORD: Sys A CW start level: _____ cc Sys A CW final level: _____ cc Sys A CW leakage: _____ cc Sys A CCW start level: _____ cc Sys A CCW final level: _____ cc Sys A CCW leakage: _____ cc RECORD: Sys A +P start level: _____ cc Sys A +P final level: _____ cc Sys A +P leakage: _____ cc Sys B +P start level: _____ cc Sys B +P final level: _____ cc Sys B +P leakage: _____ cc RECORD: Sys A -P start level: _____ cc Sys A -P final level: _____ cc Sys A -P leakage: _____ cc Sys B -P start level: _____ cc Sys B -P final level: _____ cc Sys B -P leakage: _____ cc	

Step	Location	Instructions	Remarks
		RECORD: Sys B CW start level: _____ cc Sys B CW final level: _____ cc Sys B CW leakage: _____ cc Sys B CCW start level: _____ cc Sys B CCW final level: _____ cc Sys B CCW leakage: _____ cc RECORD Sys A -Y start level: _____ cc Sys A -Y final level: _____ cc Sys A -Y leakage: _____ cc Sys B -Y start level: _____ cc Sys B -Y final level: _____ cc Sys B -Y leakage: _____ cc	
i	S14-137 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR valve (G4PR2) to 8±2 psig as indicated on RCS FILL gauge (G42PG1).	
j	CM-RCS	Remove leak tester.	
k	A14-179	Connect A14-179 adapters (12) to parallel links of G42FH6 hose assembly. NOTE When the fuel bladder and engine leak checks have been complied with, steps "a" through "e" of paragraph 4-12 will have been accomplished.	

4-10. NITROGEN PURGING (FUEL REMOVAL)

4-11. The purpose of this procedure is to remove all residual fuel from the RCS. Fuel removal is accomplished by applying nitrogen under pressure to TP23 and TP73, followed by manipulation of TP17 and TP67, TP19 and TP69, TP21 and TP71, plus the engine injection valves; thereby, allowing all residual fuel to be pushed through the various lines and hoses where it is deposited in the collector tank.

4-12. FUEL REMOVAL PROCEDURES. Removal of fuel from the RCS is accomplished by performing steps a through v.

NOTE

Prior to accomplishing the following procedures, unfold figure 4-1.

Step	Location	Instructions	Remarks
		CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs.)	
a	CM-RCS (fuel panel)	Crimp helium line in close proximity to systems A and B helium interconnect squib valve (He INTERCONNECT) to isolate helium systems. (See figure 4-2.) NOTE If explosive interconnect valve has failed to fire, crimping will not be necessary.	
b	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
c	CM-RCS (fuel panel)	Open TP23 and TP73.	

Step	Location	Instructions	Remarks
d	S14-137 (PRESSURE panel)	Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); pressurize system to 8±2 psig as indicated on RCS FILL gauge (G42PG1).	
e	S14-137	Close G42MV3.	
f	S14-137	Open G34MV4.	
g	S14-137 (VENT panel)	Open RCS LIQUID SIDE VENT valve (G42MV6).	
h	CM-RCS	Establish nitrogen flow through fuel tanks by opening TP17 and TP67; maintain 8±2 psig at TP23 and TP73 as indicated on RCS FILL gauge (G42PG1) for a minimum of 60 seconds.	
i	CM-RCS (fuel panel)	After a minimum of 60 seconds, close TP17 and TP67.	
j	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
k	CM-RCS	Establish nitrogen flow through fuel tanks by opening TP19 and TP69; maintain 8±2 psig at TP23 and TP73 as indicated on RCS FILL gauge (G42PG1) for a minimum of 60 seconds.	
l	CM-RCS (fuel panel)	After a minimum of 60 seconds, close TP19 and TP69.	
m	CM-RCS (fuel panel)	Remove G42MD5 and G42MD6 couplings from TP19 and TP69, and connect to TP21 and TP71. NOTE Maintain TP21 and TP71 closed.	

Step	Location	Instructions	Remarks
n	CM-RCS	Establish nitrogen flow through fuel tanks by opening TP21 and TP71; maintain 8±2 psig at TP23 and TP73 as indicated on RCS FILL gauge (G42PG1) for a minimum of 60 seconds.	
o	CM-RCS (fuel panel)	After a minimum of 60 seconds, close TP21 and TP71. NOTE Maintain 8±2-psig nitrogen pressure at liquid side vent couplings TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), while venting through fuel injector valves in the following step.	
p	S14-137 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12 - in pairs, according to the following sequence), set each pair to OPEN for 60 seconds, then set to close. Verify respective HOLD OPEN indicator lamps light within 5 to 10 seconds after each engine valve switch is set to OPEN. NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV2 and LV4.	

Step	Location	Instructions					Remarks
		Sequence					
System		1	2	3	4	5	6
A		C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B		C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P
q	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).					
r	S14-137 (VENT panel)	Open FROM RCS FILL valve (G42MV5) until RCS FILL gauge (G42PG1) indicates 0 (+2, -0).					
s	S14-137 (VENT panel)	When RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig, close G42MV5.					
t	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).					
u	S14-137	Perform the following: 1. Close G34MV4. 2. Note amount of fuel in collector tank. Record: _____ gallons 3. Open G34MV1 (drain fuel into scrubber tank).					
v	S14-137	When collector tank is empty, perform the following: 1. Close G34MV1. 2. Close G34MV2.					

4-13. ALCOHOL PURGING (DECONTAMINATION)

4-14. The purpose of this procedure is to clean the entire RCS (fuel side) by purging with alcohol contained within the S14-137 flushing tank (G42TK1). Positive purging is accomplished by directing pressurized alcohol (systematically) through the fuel tanks, plumbing, and injector valves. Alcohol is then routed to the backside of the fuel bladders, thereby causing contaminated alcohol to be expelled from the system.

4-15. DECONTAMINATION PROCEDURES. To purge the RCS system, perform steps a through z.

NOTE

Prior to accomplishing the following procedures, unfold figure 4-1.

Step	Location	Instructions	Remarks
a	S14-137	Open G34MV3.	
b	S14-137 (ALCOHOL FLUSH panel)	Open to RCS FILL valve (G42MV1).	
c	S14-137 (PRESSURE panel)	Slowly open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) to 18±2 psig, as indicated on ALCOHOL TANK gauge (G4PG2), and establish flow of alcohol to fill fuel tanks through liquid side vent TP23 and TP73.	
d		Maintain 18±2 psig for 30 minutes.	
e	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
f		Establish flow of alcohol through fuel tanks by opening TP17 and TP67; maintain 18±2 psig at TP23 and TP73 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	
g	CM-RCS (fuel panel)	After a minimum of 10 minutes, close TP17 and TP67.	

Step	Location	Instructions	Remarks
h	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
i	CM-RCS (fuel panel)	Perform the following steps: 1. Close TP73. 2. Remove G42MD5 and G42MD6 couplings from TP21 and TP71, and connect to TP19 and TP69. NOTE Maintain TP19 and TP69 closed. 3. Establish flow of alcohol through system B fuel tank by opening TP69; maintain 18±2 psig at TP23, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
j	CM-RCS (fuel panel)	After a minimum of 10 minutes, close TP69 and open TP73.	
k	CM-RCS (fuel panel)	Establish flow of alcohol through fuel tanks by opening TP19 and TP69; maintain 18±2 psig at TP23 and TP73 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	
l	CM-RCS (fuel panel)	After a minimum of 10 minutes, perform the following steps: 1. Close TP19 and TP69. 2. Remove G42MD5 and G42MD6 couplings from TP19 and TP69, and connect to TP21 and TP71.	

Step	Location	Instructions	Remarks
		NOTE Maintain TP21 and TP71 closed.	
m	S14-137 (RCS VALVE CONTROL panel)	Verify isolation valves LV2 and LV4 are open.	
n	CM-RCS (fuel panel)	Establish flow of alcohol through fuel tanks by opening TP21 and TP71; maintain 18±2 psig at TP23 and TP73 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	
o		After a minimum of 10 minutes, close TP21 and TP71. NOTE Maintain 18±2-psig alcohol pressure at liquid side vent coupling TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), while venting through fuel injector valves in step p.	
p	S14-137 (RCS-VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence) set each pair of switches to OPEN for 8 minutes and allow alcohol to flow through engine injector valves. Actuate engine injector valves (close and open) at 1-minute intervals during the 8-minute period.	

Step	Location	Instructions	Remarks
		NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • Should an injector valve fail, close systems A and B isolation valves.	

System	Sequence 1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

q	S14-137 (RCS VALVE panel)	Verify all switches (C19B1 through C19B12) are set to CLOSE.	
r	S14-137 (ALCOHOL FLUSH panel)	Close TO RCS FILL valve (G42MV1).	
s	CM-RCS (fuel panel)	Close TP23 and TP73.	
t	S14-137 (ALCOHOL FLUSH panel)	Open TO RCS VENT valve (G42MV2).	
u	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	

Step	Location	Instructions	Remarks
v		Establish flow of alcohol to helium side of subsystem by opening TP15 and TP65; establish static pressure of 18±2 psig as indicated on RCS VENT gauge (G4PG4). Simultaneously, vent the contaminated alcohol by opening TP17 and TP67. NOTE Maintain 18±2 psig at TP15 and TP65.	
w	CM-RCS	After 30 minutes, close TP17 and TP67.	
x	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
y	S14-137 (ALCOHOL FLUSH panel)	Close TO RCS VENT valve (G42MV2).	
z	S14-137 (PRESSURE panel)	Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).	

4-16. NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

4-17. The purpose of this procedure is to purge the helium side of the fuel system with nitrogen, thereby removing any alcohol remaining from the preceding procedure. Upon completion of the purging operation, a gas sample shall be obtained through the S14-137 sampling valve (G42MV4).

NOTE

Concentration of MMH in gas sample shall not exceed 300 ppm by volume.

4-18. HELIUM PURGING AND SAMPLING PROCEDURES. To accomplish purging and sampling procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
b	S14-137 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
c	CM-RCS (fuel panel)	Open TP23 and TP73.	
d	S14-137 (PRESSURE panel)	Perform the following steps: 1. Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and fill fuel subsystem to static pressure of 8±2 psig as indicated by RCS FILL gauge (G42PG1). Simultaneously, vent through TP15 and TP65. 2. Maintain static condition for 15 minutes. 3. Note and record pressure indication on NITROGEN SUPPLY gauge (G4PG1). Record: _____	

Step	Location	Instructions	Remarks
e	S14-137 (PRESSURE panel)	Increase nitrogen pressure at TP23 and TP73 to 30 psig by opening NITROGEN PURGE PRESSURE REGULATOR (G4PR2), as indicated by RCS FILL gauge (G42PG1).	
f	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
g	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
h	CM-RCS (helium panels) S14-137 (PRESSURE panel)	Establish a flow of nitrogen by opening TP8 and TP58. Simultaneously, open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 8±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), for a minimum of 10 minutes.	
i	CM-RCS (fuel panel)	Following a 10-minute circulation period, close TP15 and TP65.	
j	CM-RCS (helium panels)	Close TP8 and TP58.	
k	S14-137 (PRESSURE panel)	Increase NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
l	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2), and increase pressure at TP23 and TP73 to 40±2 psig as indicated on RCS FILL gauge (G42PG1).	
m	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	

Step	Location	Instructions	Remarks
n	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
o	CM-RCS (fuel panel)	Open TP15 and TP65.	
p	CM-RCS (helium panels) S14-137 (PRESSURE panel)	Open TP8 and TP58; simultaneously, open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 36 psig at TP8 and TP58 as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
q	S14-137	Close G34MV3.	
r	S14-137	Open G42MV4 and vent for 60 seconds.	
s	S14-137	After 60 seconds, close G42MV4. NOTE • Attach tygon tubing to Hoke bottle, make ready to receive gas sample. • Obtain gas sample (minimum of 180 cubic inches) downstream of TP15 and TP65.	
t	S14-137	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent through Hoke bottle for 1 minute.	

Step	Location	Instructions	Remarks
u	S14-137	After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4.	
v	S14-137	Open G34MV3.	
w	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and reduce pressure at TP15 and TP65 to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	
x	S14-137 (Hoke bottle)	Label bottle TP15 and TP65, and specify MMH sample. NOTE • Gas sample shall be expedited to predesignated test facility for analysis. • Concentration of MMH in gas sample shall not exceed 300 ppm by volume. • If gas sample MMH concentration exceeds 300 ppm, steps a through x shall be repeated.	
y	CM-RCS (helium panels)	Close TP8 and TP58.	
z	CM-RCS (fuel panel)	Close TP15 and TP65.	

4-19. NITROGEN PURGING AND SAMPLING (FUEL SYSTEM)

4-20. The purpose of this procedure is to purge the fuel side of the system with nitrogen, thereby removing any alcohol remaining from the alcohol purge procedure (paragraph 4-13). Upon completion of the purging operation, a gas sample shall be obtained through the S14-137 sampling valve (G42MV4).

NOTE

Concentration of MMH in gas sample shall not exceed 300 ppm by volume.

4-21. FUEL PURGING AND SAMPLING PROCEDURES. To accomplish the purging and sampling procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	CM-RCS (fuel panel)	Open TP17 and TP67.	
b	S14-137 (VENT panel)	Perform the following steps: 1. Close FROM RCS VENT valve (G42MV3). 2. Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
d	S14-137 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR valve (G4PR2); establish flow of nitrogen through fuel tanks while maintaining 8±2-psig pressure at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
e	CM-RCS (fuel panel)	After a minimum of 10 minutes, perform the following steps: 1. Close TP17 and TP67. 2. Close TP23.	

Step	Location	Instructions	Remarks
f	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
g	CM-RCS (fuel panel)	Perform the following steps: 1. Remove G42MD5 and G42MD6 couplings from TP21 and TP71, and connect to TP19 and TP69. NOTE Maintain TP19 and TP69 closed. 2. Open TP19 and establish flow of nitrogen through SYSTEM A fuel tank; maintain 8±2 psig at TP73 for a minimum of 6 minutes.	
h	CM-RCS (fuel panel)	After a minimum of 6 minutes, perform the following steps: 1. Close TP19. 2. Open TP23.	
i	CM-RCS (fuel panel)	Establish flow of nitrogen through fuel tanks by opening TP19 and TP69; maintain 8±2 psig at TP23 and TP73 for a minimum of 6 minutes.	
j	CM-RCS (fuel panel)	After a minimum of 6 minutes, close TP19 and TP69.	
k	CM-RCS (fuel panel)	Perform the following steps: 1. Remove G42MD5 and G42MD6 couplings from TP19 and TP69, and connect to TP21 and TP71.	

Step	Location	Instructions	Remarks
		NOTE Maintain TP21 and TP71 closed.	
	S14-137 (RCS VALVE CONTROL panel)	2. Verify isolation valves LV2 and LV4 are open.	
l	CM-RCS (fuel panel)	Establish a flow of nitrogen through fuel tanks by opening TP21 and TP71; maintain 8±2 psig at TP23 and TP73 for a minimum of 15 minutes.	
m	CM-RCS (fuel panel)	After a minimum of 15 minutes, close TP21 and TP71.	
n	S14-137 (PRESSURE panel)	Maintain 8±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), while venting through fuel injector valves in step o.	
o	S14-137 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), set each pair of switches to OPEN for 2 minutes (maximum) and allow nitrogen to flow through engine injector valves. Actuate injector valves (close and open) at 15-second intervals during 2-minute intervals. NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch.	

Step	Location	Instructions	Remarks
		• In case of an engine valve failure, close system A and system B isolation valves LV2 and LV4.	

System	Sequence					
	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

p	S14-137 (RCS VALVE CONTROL panel)	Verify switches C19B1 through C19B12 are set to CLOSE.	
q	S14-137 (PRESSURE panel)	Increase nitrogen pressure to 40±2 psig at TP23 and TP73 by adjusting NITROGEN PURGE PRESSURE REGULATOR (G4PR2) as indicated on RCS FILL gauge (G42PG1).	
r	S14-137	Close G34MV3.	
s	CM-RCS (fuel panel)	Open TP21 and TP71.	
t	S14-137	Open G42MV4 and vent for 60 seconds.	
u	S14-137	After 60 seconds, close G42MV4.	
		NOTE • Attach tygon tubing to Hoke bottle, make ready to receive gas sample. • Obtain gas sample (minimum of 180 cubic inches) downstream of TP21 and TP71.	

Step	Location	Instructions	Remarks
v	S14-137	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent through Hoke bottle for 1 minute.	
w	S14-137	After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4.	
x	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
y	S14-137	Open G34MV3.	
z	S14-137 (Hoke bottle)	Label bottle TP21 and TP71, and specify MMH sample. NOTE • Gas sample shall be expedited to predesignated test facility for analysis. • Concentration of MMH in gas sample shall not exceed 300 ppm by volume. • If gas sample MMH concentration exceeds 300 ppm, steps a through z shall be repeated.	

4-22. VACUUM DRY AND SHUTDOWN.

4-23. The purpose of these procedures is to reduce the pressure within the fuel system, thereby boiling off any remaining alcohol not previously removed by nitrogen purging. With the system dry, and with 10±2-psig nitrogen pressure in the fuel tank, the system is ready for return shipment to the Contractor's facility and subsequent inspection/analysis.

NOTE

If a-c power is not available and vacuum pump cannot be used, proceed to paragraph 4-25, step a.

4-24. VACUUM DRY. Vacuum dry procedures are performed as follows:

Step	Location	Instructions	Remarks
a	CM-RCS (fuel panel)	Close TP21 and TP71.	
b	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	CM-RCS S14-137	Open TP17 and TP67, and reduce pressure (40-lbs static) at TP23 and TP73 to 0 (+2, -0) psig as indicated on RCS FILL gauge (G42PG1).	
d	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
e	CM-RCS (helium panel)	Open TP8 and TP58.	
f	S14-137 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and establish 5±2 psig at TP8 and TP58 as indicated by RCS HELIUM CHECK VALVE gauge (G4PG3).	
g	CM-RCS (fuel panel)	Close the following: 1. TP23 2. TP73 3. TP17 4. TP67	

Step	Location	Instructions	Remarks
h	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
i	S14-137 (interface panel)	Disconnect flex hose 95580 (G42FH2) from FUEL LIQUID SIDE VENT connection.	
j	S14-137 (interface panel)	Disconnect flex hose 95580 (G42FH4) from RCS FUEL FILL connection and connect to FUEL LIQUID SIDE VENTS connector.	
k	S14-137 (vacuum pump)	Manually rotate shaft of vacuum pump motor and verify presence of oil in vacuum pump sight glass.	
l	S14-137 (POWER CONTROL panel)	Set VACUUM PUMP switch to ON. Allow a 15-minute warmup period.	
m	S14-137 (on top of scrubber tank)	Close G45MV2.	
n	S14-137 (VACUUM panel)	Open LIQUID TRAP TO RCS FILL valve (G50MV1) and LIQUID TRAP TO VACUUM PUMP valve (G50MV2).	
o	CM-RCS (fuel panel)	Open TP17 and TP67.	
p	S14-137 (PRESSURE panel)	Evacuate system until 27.4 (+0.5, -1.0) inches of vacuum is indicated on RCS FILL gauge (G42PG1). Maintain vacuum for 30 minutes.	
q	CM-RCS (fuel panel)	After 30 minutes, close TP17 and TP67.	
r	S14-137 (VACUUM panel)	Close LIQUID TRAP TO RCS FILL valve (G50MV1) and LIQUID TRAP TO VACUUM PUMP valve (G50MV2).	
s	S14-137 (POWER CONTROL panel)	Set VACUUM PUMP switch to OFF.	
t	S14-137 (on top of scrubber tank)	Open G45MV2.	

Step	Location	Instructions	Remarks
u	CM-RCS (helium panel)	Close TP8 and TP58.	
v	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
w	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
x	S14-137 (PRESSURE panel)	Crack NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 0 (+2, -0) psig.	
y	CM-RCS (fuel panel)	To establish a nitrogen pressure of 0 (+2, -0) psig inside fuel tanks, open TP17 and TP67.	
z	S14-137 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
aa	CM-RCS S14-137	Open fuel vent valve coupling TP15 and TP65, and reduce pressure at helium check valve ports TP8 and TP58 to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	

4-25. CM-RCS AND S14-137 SHUTDOWN. Shutdown procedures are performed as follows:

Step	Location	Instructions	Remarks
a	S14-137 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and establish nitrogen flow through drain vent couplings TP17 and TP67 until a static pressure of 10±2 psig is obtained as indicated by RCS FILL gauge (G42PG1).	
b	CM-RCS	Close TP17 and TP67.	
c	CM-RCS	Close TP15 and TP65.	

Step	Location	Instructions	Remarks
d	S14-137	Secure K-bottles (5).	
e	S14-137 (VENT panel)	Open FROM RCS FILL valve (G42MV5).	
f	S14-137 (PRESSURE panel)	Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1).	
g	S14-137 (PRESSURE panel) (VENT panel)	When RCS FILL gauge (G42PG1) indicates zero pressure, proceed as follows: 1. Close FROM RCS FILL valve (G42MV5). 2. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1). NOTE Step g completes CM-RCS fuel system deactivation.	
h	S14-137 (VACUUM panel)	Open the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1) 2. LIQUID TRAP TO VACUUM PUMP (G50MV2) 3. TO VACUUM BREAKER (G50MV3).	
i	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
j	S14-137 (VENT panel)	Close FROM RCS VENT valve (G42MV3).	
k	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	

Step	Location	Instructions	Remarks
l	S14-137 (VACUUM panel)	Close the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1) 2. LIQUID TRAP TO VACUUM PUMP (G50MV2) 3. TO VACUUM BREAKER (G50MV3).	
m	S14-137 (inside cart)	Close the following valves: 1. G34MV3 2. G45MV2.	
n	S14-137 (POWER CONTROL panel)	Set the following switches to OFF: 1. AC-DC EMERGENCY CONTROL 2. 115 VAC 3. 28 VDC POWER SUPPLY. NOTE If BATTERY SUPPLY was used, set switch to OFF.	
o	CM-RCS	Disconnect all fluid lines and electrical connectors from the CM. NOTE Refer to section VIII for information relative to cleaning fluids and the cleaning of S14-137.	

4-26. STATUS CHARTS—VALVE POSITIONS

4-27. The following charts provide an instant checklist for determining valve positions during any portion of the individual deactivation procedures. These charts can be utilized as an aid during trouble analysis, or as a guide when attempting to ascertain the best place to establish a hold.

NORMAL MISSION

S14-137

EXPULSION OF USABLE PROPELLANTS

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
G4PR1	X																								
G4PR2	X												O							X					
G4MV2	X																								
K-Bottles	X					O																			
G34MV1	X																								
G34MV2	X															O									
G34MV3	X																								
G34MV4	X															O									X
G42MV1	X																								
G42MV2	X																								
G42MV3	X																		O						
G42MV4	X																								
G42MV5	X											O					X								
G42MV6	X											O					X								
G45MV2	X							O																	
G50MV1	X																								
G50MV2	X																								
G50MV3	X																								
TP8	X									O													X		
TP58	X								O													X			
TP15	X																	O						X	
TP65	X																	O						X	
TP17	X										O						X								
TP67	X										O						X								
TP19	X																								
TP69	X																								
TP21	X																								
TP71	X																								
TP23	X																								
TP73	X																								

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-137

NITROGEN PURGING (FUEL REMOVAL)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
G4PR1	X																						
G4PR2	X				O													X					
G4MV2	X		O																		X		
K-Bottles	O																						
G34MV1	X																					O	X
G34MV2	O																						X
G34MV3	X																						
G34MV4	X						O															X	
G42MV1	X																						
G42MV2	X																						
G42MV3	O					X																	
G42MV4	X																						
G42MV5	X																		O	X			
G42MV6	X							O			X												
G45MV2	O																						
G50MV1	X																						
G50MV2	X																						
G50MV3	X																						
TP8	X																						
TP58	X																						
TP15	X																						
TP65	X																						
TP17	X								O	X													
TP67	X								O	X													
TP19	X											O	X										
TP69	X											O	X										
TP21	X														O	X							
TP71	X														O	X							
TP23	X			O																			
TP73	X			O																			

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-137

ALCOHOL PURGING (DECONTAMINATION)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X			O																							X
G4PR2	X																										
G4MV2	X																										
K-Bottles	O																										
G34MV1	X																										
G34MV2	X																										
G34MV3	X	O																									
G34MV4	X																										
G42MV1	X		O																X								
G42MV2	X																				O					X	
G42MV3	X																										
G42MV4	X																										
G42MV5	X																										
G42MV6	X					O			X													O			X		
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP8	X																										
TP58	X																										
TP15	X																						O				
TP65	X																						O				
TP17	X						O	X															O	X			
TP67	X						O	X															O	X			
TP19	X											O	X														
TP69	X									O	X	O	X														
TP21	X														O	X											
TP71	X														O	X											
TP23	O																			X							
TP73	O									X	O									X							

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-137

NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	
G4PR1	X																											
G4PR2	X				O			X	O						X		O							X				
G4MV2	X	O					X						O	X															
K-Bottles	O																											
G34MV1	X																											
G34MV2	X																											
G34MV3	O																	X					O					
G34MV4	X																											
G42MV1	X																											
G42MV2	X																											
G42MV3	X		O																									
G42MV4	X																		O	X	O	X						
G42MV5	X																											
G42MV6	X																											
G45MV2	O																											
G50MV1	X																											
G50MV2	X																											
G50MV3	X																											
TP8	X								O		X						O									X		
TP58	X								O		X						O									X		
TP15	O									X						O											X	
TP65	O									X						O											X	
TP17	X																											
TP67	X																											
TP19	X																											
TP69	X																											
TP21	X																											
TP71	X																											
TP23	X			O																								
TP73	X			O																								

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION S14-137

NITROGEN PURGING AND SAMPLING (FUEL SYSTEM)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X																										
G4PR2	X				O																				X		
G4MV2	X			O																							
K-Bottles	O																										
G34MV1	X																										
G34MV2	X																										
G34MV3	O																		X							O	
G34MV4	X																										
G42MV1	X																										
G42MV2	X																										
G42MV3	O		X																								
G42MV4	X																				O	X	O	X			
G42MV5	X																										
G42MV6	X		O				X																				
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP8	X																										
TP58	X																										
TP15	X																										
TP65	X																										
TP17	X	O				X																					
TP67	X	O				X																					
TP19	X							O	X	O	X																
TP69	X									O	X																
TP21	X												O	X						O							
TP71	X												O	X						O							
TP23	O					X			O																		
TP73	O																										

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION S14-137

VACUUM DRY

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																											
G4PR2	X						O																X		C			
G4MV2	O				X																			O				
K-Bottles	O																											
G34MV1	X																											
G34MV2	X																											
G34MV3	O																											
G34MV4	X																											
G42MV1	X																											
G42MV2	X																											
G42MV3	X																										O	
G42MV4	X																											
G42MV5	X																											
G42MV6	X		O						X												O							
G45MV2	O													X														
G50MV1	X														O					X								
G50MV2	X														O					X								
G50MV3	X																											
TP8	X					O															X							
TP58	X					O															X							
TP15	X																											O
TP65	X																											O
TP17	X			O				X								O		X							O		
TP67	X			O				X								O		X							O		
TP19	X																											
TP69	X																											
TP21	O	X																										
TP71	O	X																										
TP23	O							X																				
TP73	O							X																				

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-137

SHUTDOWN

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
G4PR1	X						O	X								
G4PR2	C	O								X						
G4MV2	O											X				
K-Bottles	O				X											
G34MV1	X															
G34MV2	X															
G34MV3	O														X	
G34MV4	X															
G42MV1	X															
G42MV2	X															
G42MV3	O										X					
G42MV4	X															
G42MV5	X					O		X								
G42MV6	X															
G45MV2	O														X	
G50MV1	X								O					X		
G50MV2	X								O					X		
G50MV3	X								O					X		
TP8	X															
TP58	X															
TP15	O			X												
TP65	O			X												
TP17	O		X													
TP67	O		X													
TP19	X															
TP69	X															
TP21	X															
TP71	X															
TP23	X															
TP73	X															

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

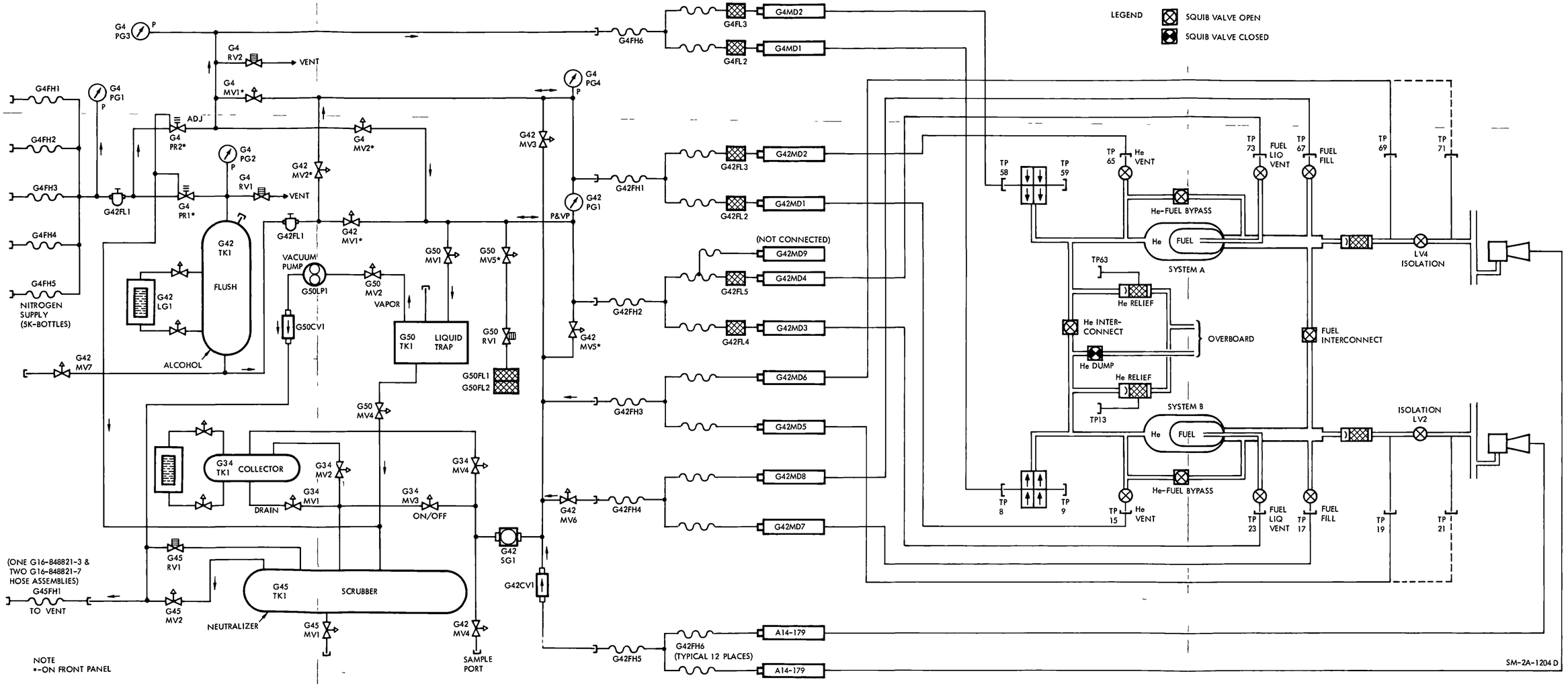


Figure 4-1 CM-GSE Fluid Line Interface, S14-137 (Normal Mission)

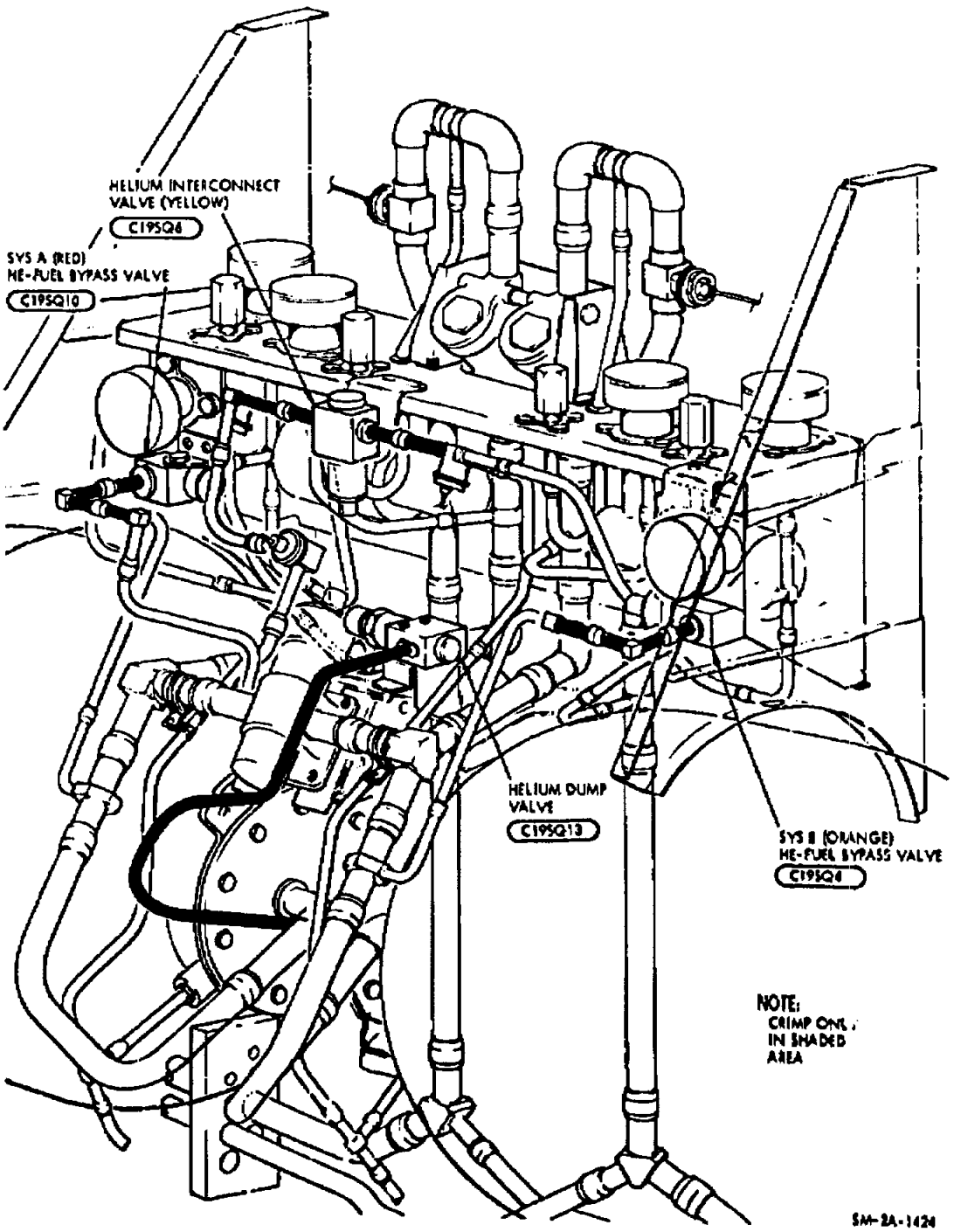


Figure 4-2. CM Fuel Panel Squib Valve Crimping Locations

SECTION V

OXIDIZER SYSTEM DEACTIVATION PROCEDURES FOR NORMAL MISSION OR HIGH-ALTITUDE ABORT

5-1. GENERAL

5-2. This section provides the procedures required to deactivate and prepare the oxidizer side of the CM-RCS for return shipment to the Contractor's facility. Procedural data, as presented in this section is applicable only to normal or high-altitude abort conditions. Information relative to oxidizer system deactivation, following a pad or low-altitude abort, may be found in section VII.

5-3. CM-GSE ELECTRICAL INTERFACE—S14-138

CAUTION

To prevent damage by any mixup in similar cables of the fuel and oxidizer units, make certain that all fuel cables are removed from the CM and stowed before hooking up oxidizer unit to CM.

5-4. For oxidizer system deactivation electrical hookup, see figure 9-3 and proceed as follows:

a. On S14-138, connect receptacle W4J1 of cable W4 (G16-848789) to plug P99 of CM C05W3 wiring harness (removed from J8 on C19A1 RCS control box).

b. Verify that plug W4P1 of cable W4 is connected to SYSTEM A ENGINE VALVES receptacle (J3) on S14-138.

c. On S14-138, connect receptacle W5J1 of cable W5 (G16-880569-41) to plug P104 of CM C05W3 wiring harness (removed from J104 on CM C05W7 wiring harness.

d. Verify that plug W5P1 of cable W5 is connected to SYSTEM B ENGINE VALVES receptacle (J4) on S14-138.

e. On S14-138, connect cable W3 (G16-848797-11) to CM terminal board C05TB21 as indicated in figures 9-3 and 9-4.

f. Verify that plug W3P1 of cable W3 is connected to OXIDIZER ISOLATION VALVE receptacle (J2) on S14-138.

NOTE

If 115-vac 60-cps facility power is not available at interim port, use battery sources supplied with S14-138 deactivation unit.

g. Verify that plug W2P2 of cable W2 (G16-848798-11) is connected to AC POWER receptacle (J1) on S14-138.

h. Verify that plug W2P1 of cable W2 is connected to receptacle W1J1 of cable W1 (G16-848798-21).

i. Connect plug W1P1 of cable W1 to facility 115-vac 60-cps power.

5-5. CM-GSE FLUID LINE INTERFACE—S14-138

CAUTION

To prevent damage by any mixup in identical and/or similar lines of the fuel and oxidizer units, make certain that all fuel lines and are removed from the A14-179 adapters on the CM and stowed before hooking up oxidizer unit to CM.

5-6. For oxidizer system deactivation fluid line hookup (normal mission), see figures 2-18 and 5-1, and proceed as follows:

CAUTION

When handling flex lines, use care to prevent kinking.

a. Verify G4FH6 hose assembly (95625) is connected to RCS OXID CHECK VALVES—HELIUM PANEL port on S14-138.

b. Connect G4MD1 coupling (ME144-0023-0021) of G4FH6 to helium check valve port (TP10) on system B helium panel of CM.

c. Connect G4MD2 coupling (ME144-0023-0021) of G4FH6 to helium check valve port (TP60) on system A helium panel of CM.

d. Verify G42FH1 hose assembly (95579) is connected to RCS OXID VENT port on S14-138.

e. Connect G42MD1 coupling (ME273-0011-0002) of G42FH1 to system B HE VENT port (TP14) on RCS oxidizer panel of CM.

f. Connect G42MD2 coupling (ME273-0011-0002) of G42FH1 to system A HE VENT port (TP64) on RCS oxidizer panel of CM.

g. Verify G42FH2 hose assembly (95881) is connected to OXID LIQUID SIDE VENTS port on S14-138.

h. Connect G42MD3 coupling (ME273-0019-0002) of G42FH2 to system B OX LIQ VENT port (TP22) on RCS oxidizer panel of CM.

i. Obtain a sample of flushing fluid (freon) within flushing tank (G42TK1) by accomplishing the following steps:

1. Disconnect G42MD9 coupling from G42FH2 hose assembly.

2. Open G42MV1.

3. Position suitable container for securing sample.

4. Open K-bottles and crack G4PR1 until fluid flows from open end of G42FH2 hose assembly.

5. When sample has been taken, close G4PR1, K-bottles, and G42MV1.

6. Re-install G42MD9 coupling.

7. Store sample; then forward to predesignated test facility for analysis with gas sample obtained in paragraph 5-24, step u.

j. Connect G42MD4 coupling (ME273-0019-0002) of G42FH2 to system A OX LIQ VENT port (TP72) on RCS oxidizer panel of CM.

NOTE

Verify G42MD9 coupling (ME273-0011-0002) and G16-848811-5 hose assembly are connected to 8R6BX-SS tee.

k. Verify G42FH3 hose assembly (G16-848826-5) is connected to TEST POINT OXID PANEL port on S14-138.

l. Connect G42MD5 coupling (ME144-0023-0021) of G42FH3 to system B test port (TP18) on RCS oxidizer panel of CM.

m. Connect G42MD6 coupling (ME144-0023-0021) of G42FH3 to system A test port (TP68) on RCS oxidizer panel of CM.

n. Verify G42FH4 hose assembly (95581) is connected to RCS OXID FILL port on S14-138.

NOTE

Verify G42MD7 and G42MD8 couplings are connected to G42FH4 hose assembly.

o. Connect G42MD7 coupling (ME273-0019-0002) of G42FH4 to system B OX FILL port (TP16) on RCS oxidizer panel of CM.

p. Connect G42MD8 coupling (ME273-0019-0002) of G42FH4 to system A OX FILL port (TP66) on RCS oxidizer panel of CM.

q. Verify G42FH5 hose assembly (G16-848824-5) is connected to RCS ENGINES port on S14-138.

r. Verify G42FH6 hose assembly (G16-848825-5) is connected to G42FH5 hose assembly (G16-848824-5).

s. See figures 3-3 and 9-5, and verify A14-179 adapters are installed in the 12 RCS engines.

t. Connect A14-179 adapters (12) to parallel links of G42FH6 hose assembly.

u. Verify G45FH1 hose assembly (G16-848821-5) is connected to VENT port on S14-138.

v. Connect both G16-848821-9 flex hose extensions and unions to G16-848821-5 hose assembly. (See figure 2-18.)

5-7. EXPULSION OF USABLE PROPELLANTS

5-8. The purpose of this procedure is to measure the amount of usable propellant (oxidizer) remaining after a normal mission or high-altitude abort. Propellant expulsion is accomplished by compressing the teflon bladders (systems A and B), thereby expelling usable propellant into the collector tank.

5-9. EXPULSION PROCEDURES. To expel usable propellants from the bladders, proceed as follows:

NOTE

- Verify electrical interface and fluid line interface have been accomplished per paragraphs 5-3 and 5-5.
- Prior to proceeding further, unfold figure 5-1.

Step	Location	Instructions	Remarks
a	S14-138 (RCS POWER CONTROL panel)	Perform the following steps: NOTE If 115-vac, 60-cps facility power is not available, leave 115 VAC-ON-OFF switch at OFF and set 28 VDC-BATTERY SUPPLY-CHARGE switch to BATTERY SUPPLY. 1. Verify VACCUM PUMP switch at OFF. 2. Set AC-DC EMERGENCY CONTROL switch to on (up). 3. Set 28 VDC-POWER SUPPLY-CHARGE switch to POWER SUPPLY. 4. Set 115 VAC-ON-OFF switch to ON; verify 115 VAC ON indicator lamp is lighted.	

Step	Location	Instructions	Remarks
		CAUTION	
	S14-138 (RCS VALVE CONTROL panel)	In case of an engine valve failure (engine valve HOLD OPEN indicator lamp lights), close system A and B isolation valves as follows:	
		• Set systems A and B isolation valve reset switches to RESET.	
		• Momentarily hold systems A and B ISOLATION VALVE switches to CLOSE. Verify CLOSED indicator lamps are lighted.	
		5. Verify system A and system B isolation valves (LV1 and LV3) are open.	
		6. Verify switches C19B1 through C19B12 in CLOSE position. (Engine oxidizer valves closed.)	
b	CM RCS (oxidizer panel)	Verify the following squib valve positions:	
		1. He-oxidizer bypass (2) open.	
		2. Helium interconnect open.	
		3. Oxidizer interconnect open.	
		4. Oxidizer dump (2) closed.	

Step	Location	Instructions	Remarks
		CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque valve 175 in.-lbs.)	
c	CM-RCS (oxidizer panel)	Crimp lines in close proximity to explosive helium bypass valves (He-OXID BYPASS) to isolate oxidizer side of system from helium side. (See figure 5-2.) NOTE If explosive bypass valve has failed to fire, crimping will not be necessary.	
d	S14-138 (PRESSURE panel)	Verify the following valves are set at full decrease: 1. FREON TANK PRESSURE REGULATOR (G4PR1) 2. NITROGEN PURGE PRESSURE REGULATOR (G4PR2)	
e	S14-138	Open K-bottle valves (5).	
f	S14-138 (PRESSURE panel)	Verify NITROGEN SUPPLY gauge (G4PG1) indicates 1500 psig minimum.	
g	S14-138	Open G45MV2.	
h	CM-RCS (sys A, He panel)	Open TP60.	
i	CM-RCS (sys B, He panel)	Open TP10.	

Step	Location	Instructions	Remarks
j	CM-RCS (oxidizer panel)	Open TP16 and TP66.	
k	S14-138 (VENT panel)	Open the following valves: 1. FROM RCS FILL (G42MV5) 2. FROM LIQUID SIDE VENT (G42MV6).	
l	S14-138 (PRESSURE panel)	Open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 10 (+0, -5) psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
m	S14-138 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 40±2 psig, as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
n	S14-138 (PRESSURE panel)	Note and record pressure indication on RCS FILL gauge (G42PG1). Record:_____	
o	S14-138	Open the following valves: 1. G32MV2 2. G32MV4.	

Step	Location	Instructions	Remarks
p	S14-138 (PRESSURE panel)	When RCS FILL gauge (G42PG1) reads 0 (+2, -0) psig, perform the following:	
	S14-138 (VENT panel)	1. Close the following valves: (a) FROM RCS FILL (G42MV5) (b) FROM RCS LIQUID SIDE VENT (G42MV6).	
	CM-RCS (oxidizer panel)	2. Close TP16 and TP66.	
q	CM-RCS (oxidizer panel)	Open TP14 and TP64; allow pressure to stabilize at 40 psig as indicated on RCS VENT gauge (G4PG4).	
r	S14-138 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
s	S14-138 (PRESSURE panel)	After a minimum of 60 seconds, close NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and reduce pressure at TP14 and TP64 to 0 (+2, -0) psig, as indicated on RCS VENT gauge (G4PG4).	
t	S14-138 (collector tank)	Record amount of propellant (oxidizer) within collector tank as shown on sight gauge. Record: _____ gallons	
u	CM-RCS (sys A, He panel)	Close TP60.	

Step	Location	Instructions	Remarks
v	CM-RCS (sys B, He panel)	Close TP10.	
w	CM-RCS (oxidizer panel)	Close TP14 and TP64.	
x	S14-138	Close G32MV4.	

5-9A. OXIDIZER BLADDER LEAK-CHECK

NOTE

Compliance with the oxidizer bladder leak check procedures shall be determined by the NASA LST Director.

5-9B. The purpose of this procedure is to re-inflate the oxidizer bladders, as well as check for leaks. Nitrogen pressure is applied to the bladders and a leak tester is used to measure the displaced water in a manometer for a rate of leakage.

5-9C. LEAK-CHECK PROCEDURES. To accomplish the oxidizer bladder leak-check, proceed as follows:

Step	Location	Instructions	Remarks
		CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs)	
a	CM-RCS (oxidizer panel)	Crimp helium line in close proximity to systems A and B helium interconnect squib valve (He INTERCONNECT) to isolate helium systems. (See figures 5-1 and 5-2.) NOTE If explosive interconnect valve has failed to fire, crimping will not be necessary.	
b	S14-138	Provide a leak-test setup by connecting a suitable length of tubing (tygon) to sampling valve (G42MV4). Attach free end of tubing to test pan. (Refer to "Leak Tester Setup" in paragraph 2-18A.)	

Step	Location	Instructions	Remarks
c	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
d	CM-RCS (oxidizer panel)	Open TP22 and TP72.	
e	S14-138 (PRESSURE panel)	Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), pressurize system to 8±2 psig as indicated on RCS FILL gauge (G42PG1).	
f	CM-RCS (oxidizer panel)	Open TP64. Take reading of water level on manometer at start of test. Record reading on space provided in step h.	
g	S14-138	Open G42MV4 (sampling valve) and begin 15-minute time check.	
h	Leak tester	After 15±0.2 minutes, record final water level on manometer and determine water level drop-page across expulsion bladder of system A oxidizer tank. RECORD: Sys A start level: _____ cc Sys A final level: _____ cc Sys A leakage: _____ cc	
i	CM-RCS (oxidizer panel)	Close TP64.	
j	S14-138	Close G42MV4 (sampling valve). NOTE If necessary, refill bubble manometer with water.	

Step	Location	Instructions	Remarks
k	CM-RCS (oxidizer panel)	Open TP14. Take reading of water level on manometer at start of test. Record reading on space provided in step m.	
l	S14-138	Open G42MV4 (sampling valve) and begin 15-minute time check.	
m	Leak tester	After 15±0.2 minutes, record final water level on manometer and determine water level droppage across expulsion bladder of system B oxidizer tank. RECORD: Sys B start level: _____ cc Sys B final level: _____ cc Sys B leakage: _____ cc	
n	CM-RCS (oxidizer panel)	Close TP14.	
o	S14-138	Close G42MV3.	
p	S14-138	Close G42MV4 and remove leak tester.	

5-9D. ENGINE OXIDIZER LEAK-CHECK

NOTE

Compliance with the engine oxidizer leak-check procedures shall be determined by the NASA LST Director.

5-9E. The purpose of this procedure is to check the engine oxidizer injector valves for leakage by applying pressurized nitrogen (40±2 psig) to the backside of each valve.

5-9F. LEAK-CHECK PROCEDURES. To accomplish the oxidizer injector valve leak-check, proceed as follows:

Step	Location	Instructions	Remarks
a	CM-RCS	Verify A14-179 nozzle adapter installed in each engine nozzle, but disconnect parallel links of G42FH6 hose assembly. 1. Sys A +yaw 2. Sys B +yaw 3. Sys A CW 4. Sys A CCW 5. Sys A +pitch 6. Sys B +pitch 7. Sys A -pitch 8. Sys B -pitch 9. Sys B CW 10. Sys B CCW 11. Sys A -yaw 12. Sys B -yaw	
b	CM-RCS	Provide a leak-test setup by connecting a suitable length of hose (tygon) to each nozzle adapter installed in systems A and B +yaw.	

Step	Location	Instructions	Remarks
		engines. Attach free end of each hose to test pan. (Refer to "Leak Tester Setup" in paragraph 2-18A.)	
c	Leak Tester	Take readings of water level on manometers at start of test. Record readings on spaces provided in step h.	
d	S14-138	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3). NOTE Isolation valves LV1 and LV3 should already be open following a normal mission or high-altitude abort.	
e	Leak tester	Begin 10-minute time check.	
f	Leak tester	After 10±0.2 minutes, read final water level on manometers and determine water level droppage across system A and system B +yaw engine oxidizer injector valves. Record findings on spaces provided in step h.	
g	Leak tester	Remove leak-test setup from systems A and B +yaw engines. NOTE If necessary, refill bubble manometer with water.	

Step	Location	Instructions	Remarks
h	Leak tester	Provide a leak-test setup for all remaining RCS engine oxidizer injector valves and repeat steps c, e and f for each pair of engines in the following sequence: RECORD: Sys A +Y start level: _____ cc Sys A +Y final level: _____ cc Sys A +Y leakage: _____ cc Sys B +Y start level: _____ cc Sys B +Y final level: _____ cc Sys B +Y leakage: _____ cc RECORD: Sys A CW start level: _____ cc Sys A CW final level: _____ cc Sys A CW leakage: _____ cc Sys A CCW start level: _____ cc Sys A CCW final level: _____ cc Sys A CCW leakage: _____ cc RECORD: Sys A +P start level: _____ cc Sys A +P final level: _____ cc Sys A +P leakage: _____ cc Sys B +P start level: _____ cc Sys B +P final level: _____ cc Sys B +P leakage: _____ cc RECORD: Sys A -P start level: _____ cc Sys A -P final level: _____ cc Sys A -P leakage: _____ cc Sys B -P start level: _____ cc Sys B -P final level: _____ cc Sys B -P leakage: _____ cc	

Step	Location	Instructions	Remarks
		RECORD: Sys B CW start level: _____ cc Sys B CW final level: _____ cc Sys B CW leakage: _____ cc Sys B CCW start level: _____ cc Sys B CCW final level: _____ cc Sys B CCW leakage: _____ cc RECORD: Sys A -Y start level: _____ cc Sys A -Y final level: _____ cc Sys A -Y leakage: _____ cc Sys B -Y start level: _____ cc Sys B -Y final level: _____ cc Sys B -Y leakage: _____ cc	
i	S14-138 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR valve (G4PR2) to 8±2 psig as indicated on RCS FILL gauge (G42PG1).	
j	CM-RCS	Remove leak tester	
k	A14-179	Connect A14-179 adapters (12) to parallel links of G42FH6 hose assembly. NOTE When the oxidizer bladder and engine leak checks have been complied with, steps "a" through "e" of paragraph 5-12 will have been accomplished.	

5-10. NITROGEN PURGING (OXIDIZER REMOVAL)

5-11. The purpose of this procedure is to remove all residual oxidizer from the CM-RCS. Oxidizer removal is accomplished by applying nitrogen under pressure to TP22 and TP72, followed by manipulation of TP16 and TP66, TP18 and TP68, TP20 and TP70, plus the engine injection valves; thereby allowing all residual oxidizer to be pushed through the various lines and hoses where it is deposited in the collector tank.

5-12. OXIDIZER REMOVAL PROCEDURES. Removal of residual oxidizer from the RCS is accomplished by performing steps a through v.

NOTE

Prior to accomplishing the following procedures, unfold figure 5-1.

Step	Location	Instructions	Remarks
		CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs.)	
a	CM-RCS (fuel panel)	Crimp helium line in close proximity to systems A and B helium interconnect squib valve (He INTERCONNECT) to isolate helium systems. (See figure 5-2.) NOTE If explosive interconnect valve has failed to fire, crimping will not be necessary.	
b	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
c	CM-RCS (oxidizer panel)	Open TP22 and TP72.	

Step	Location	Instructions	Remarks
d	S14-138 (PRESSURE panel)	Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), pressurize system to 8±2 psig as indicated on RCS FILL gauge (G42PG1).	
e	S14-138	Close G42MV3.	
f	S14-138	Open G32MV4.	
g	S14-138 (VENT panel)	Open RCS LIQUID SIDE VENT valve (G42MV6).	
h	CM-RCS	Establish nitrogen flow through oxidizer tanks by opening TP16 and TP66; maintain 8±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) for a minimum of 60 seconds.	
i	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close TP16 and TP66.	
j	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
k	CM-RCS	Establish nitrogen flow through oxidizer tanks by opening TP18 and TP68; maintain 8±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) for a minimum of 60 seconds.	
l	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close TP18 and TP68.	
m	CM-RCS (oxidizer panel)	Remove G42MD5 and G42MD6 couplings from TP18 and TP68, and connect to TP20 and TP70. NOTE Maintain TP20 and TP70 closed.	

Step	Location	Instructions	Remarks
n	CM-RCS	Establish nitrogen flow through oxidizer tanks by opening TP20 and TP70; maintain 8±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) for a minimum of 60 seconds.	
o	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close TP20 and TP70. NOTE Maintain 8±2-psig nitrogen pressure at liquid side vent couplings TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), while venting through oxidizer injector valves in the following step.	
p	S14-138 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12 - in pairs, according to the following sequence), set each pair to OPEN for 60 seconds; then, set to close. Verify respective HOLD OPEN indicator lamps light within 5 to 10 seconds after each engine valve switch is set to OPEN. NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV1 and LV3.	

Step	Location	Instructions					Remarks
		Sequence					
	System	1	2	3	4	5	6
	A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
	B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P
q	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).					
r	S14-138 (VENT panel)	Open FROM RCS FILL valve (G42MV5) until RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig.					
s	S14-138 (VENT panel)	When RCS FILL gauge (G42PG1) indicates 0 (+0, -0) psig, close G42MV5.					
t	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).					
u	S14-138	Perform the following: 1. Close G32MV4. 2. Note amount of oxidizer in collector tank. Record: _____ gallons 3. Open G32MV1 (drain oxidizer into scrubber tank).					
v		When collector tank is empty, perform the following: 1. Close G32MV1. 2. Close G32MV2.					

5-13. FREON PURGING (DECONTAMINATION)

5-14. The purpose of this procedure is to clean the entire RCS (oxidizer side) by purging with freon contained within the S14-138 flushing tank (G42TK1). Positive purging is accomplished by directing pressurized freon (systematically) through the oxidizer tanks, plumbing, and injector valves. Freon is then routed to the backside of the oxidizer bladders, thereby causing contaminated freon to be expelled from the system.

5-15. DECONTAMINATION PROCEDURES. To purge the RCS system, perform steps a through z.

NOTE

Prior to accomplishing the following procedures, unfold figure 5-1.

Step	Location	Instructions	Remarks
a	S14-138	Open G32MV3.	
b	S14-138 (FREON FLUSH panel)	Open to RCS FILL valve (G42MV1).	
c	S14-138 (PRESSURE panel)	Slowly open FREON TANK PRESSURE REGULATOR (G4PR1) to 18±2 psig, as indicated on FREON TANK gauge (G4PG2), and establish flow of freon to fill oxidizer tanks through liquid side vent TP22 and TP72.	
d		Maintain 18±2 psig for 30 minutes.	
e	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
f		Establish flow of freon through oxidizer tanks by opening TP16 and TP66; maintain 18±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	

Step	Location	Instructions	Remarks
g	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, close TP16 and TP66.	
h	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
i	CM-RCS (oxidizer panel)	Perform the following steps: 1. Close TP72. 2. Remove G42MD5 and G42MD6 couplings from TP20 and TP70, and connect to TP18 and TP68. NOTE Maintain TP18 and TP68 closed. 3. Establish flow of freon through system B oxidizer tank by opening TP68; maintain 18±2 psig at TP22 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	
j	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, close TP68 and open TP72.	
k	CM-RCS (oxidizer panel)	Establish flow of freon through oxidizer tanks by opening TP18 and TP68; maintain 18±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	
l	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, perform the following steps: 1. Close TP18 and TP68. 2. Remove G42MD5 and G42MD6 couplings from TP18 and TP68, and connect to TP20 and TP70.	

Step	Location	Instructions	Remarks
		NOTE Maintain TP20 and TP70 closed.	
m	S14-138 (RCS VALVE CONTROL panel)	Verify isolation valves LV1 and LV3 are open.	
n	SM-RCS (oxidizer panel)	Establish flow of freon through oxidizer tanks by opening TP20 and TP70; maintain 18±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) for a minimum of 10 minutes.	
o		After a minimum of 10 minutes, close TP20 and TP70.	
		NOTE Maintain 18±2-psig freon pressure at liquid side vent coupling TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), while venting through oxidizer injector valves in step p.	
p	S14-138 (RCS-VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), set each pair of switches to OPEN for 8 minutes and allow freon to flow through engine injector valves. Actuate engine injector valves (close and open) at 1-minute intervals during the 8-minute period.	

Step	Location	Instructions	Remarks
		NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • Should an injector valve fail, close systems A and B isolation valves.	

System	Sequence					
	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

q	S14-138 (RCS VALVE panel)	Verify all switches (C19B1 through C19B12) are set to CLOSE.	
r	S14-138 (FREON FLUSH panel)	Close TO RCS FILL valve (G42MV1).	
s	CM-RCS (oxidizer panel)	Close TP22 and TP72.	
t	S14-138 (FREON FLUSH panel)	Open to RCS VENT valve (G42MV2).	
u	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	

Step	Location	Instructions	Remarks
v		Establish flow of freon to helium side of subsystem by opening TP14 and TP64, establish static pressure of 18±2 psig as indicated on RCS VENT gauge (G4PG4). Simultaneously, vent the contaminated freon by opening TP16 and TP66. NOTE Maintain 18±2 psig at TP14 and TP64.	
w	CM-RCS	After 30 minutes, close TP16 and TP66.	
x	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
y	S14-138 (FREON FLUSH panel)	Close TO RCS VENT valve (G42MV2).	
z	S14-138 (PRESSURE panel)	Close FREON TANK PRESSURE REGULATOR (G4PR1).	

5-16. NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

5-17. The purpose of this procedure is to purge the helium side of the oxidizer system with nitrogen, thereby removing any freon remaining from the preceding procedure. Upon completion of the purging operation, a gas sample shall be obtained through the S14-138 sampling valve (G42MV4).

NOTE

Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume.

5-18. HELIUM PURGING AND SAMPLING PROCEDURES. To accomplish purging and sampling procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
b	S14-138 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
c	CM-RCS (oxidizer panel)	Open TP22 and TP72.	
d	S14-138 (PRESSURE panel)	Perform the following steps: 1. Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and fill oxidizer subsystem to static pressure of 8±2 psig as indicated by RCS FILL gauge (G42PG1). Simultaneously, vent through TP14 and TP64. 2. Maintain static condition for 15 minutes. 3. Note and record pressure indication on NITROGEN SUPPLY gauge (G4PG1). Record: _____	

Step	Location	Instructions	Remarks
e	S14-138 (PRESSURE panel)	Increase nitrogen pressure at TP22 and TP72 to 30 psig by opening NITROGEN PURGE PRESSURE REGULATOR (G4PR2), as indicated by RCS FILL gauge (G42PG1).	
f	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
g	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
h	CM-RCS (helium panels)	Establish a flow of nitrogen by opening TP10 and TP60. Simultaneously, open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), to maintain 8±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), for a minimum of 10 minutes.	
i	CM-RCS (oxidizer panel)	Following a 10-minute circulation period, close TP14 and TP64.	
j	CM-RCS (helium panels)	Close TP10 and TP60.	
k	S14-138 (PRESSURE panel)	Increase NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
l	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2), and increase pressure at TP22 and TP72 to 40±2 psig as indicated on RCS FILL gauge (G42PG1).	

Step	Location	Instructions	Remarks
m	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2)	
n	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
o	CM-RCS (oxidizer panel)	Open TP14 and TP64	
p	CM-RCS (helium panels) S14-138 (PRESSURE panel)	Open TP10 and TP60; simultaneously open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 36 psig at TP10 and TP60 as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
q	S14-138	Close G32MV3.	
r	S14-138	Open G42MV4 and vent for 60 seconds.	
s	S14-138	After 60 seconds, close G42MV4. NOTE • Attach tygon tubing to Hoke bottle, make ready to receive gas sample. • Obtain gas sample (minimum of 180 cubic inches) downstream of TP14 and TP64.	
t	S14-138	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4.	

Step	Location	Instructions	Remarks
		4. Vent through Hoke bottle for 1 minute.	
u		After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4.	
v	S14-138	Open G32MV3.	
w	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and reduce pressure at TP14 and TP64 to 0(+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	
x	S14-138 (Hoke bottle)	Label bottle TP14 and TP64, and specify N_2O_4 sample. NOTE • Gas sample shall be expedited to predesignated test facility for analysis. • Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume. • If gas sample N_2O_4 concentration exceeds 300 ppm, steps a through x shall be repeated.	

Step	Location	Instructions	Remarks
y	CM-RCS (oxidizer panel)	Close TP10 and TP60.	
z	CM-RCS (oxidizer panel)	Close TP14 and TP64	

5-19. NITROGEN PURGING AND SAMPLING (OXIDIZER SYSTEM)

5-20. The purpose of this procedure is to purge the oxidizer side of the system with nitrogen, thereby removing any freon remaining from the freon purge procedure (paragraph 5-14). Upon completion of the purging operation, a gas sample shall be obtained through the S14-138 sampling valve (G42MV4).

NOTE

Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume.

5-21. OXIDIZER PURGING AND SAMPLING PROCEDURES. To accomplish the purging and sampling procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	CM-RCS (oxidizer panel)	Open TP16 and TP66.	
b	S14-138 (VENT panel)	Perform the following steps: 1. Close FROM RCS VENT valve (G42MV3). 2. Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
d	S14-138 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR valve (G4PR2); establish flow of nitrogen through oxidizer tanks while maintaining 8±2-psig pressure at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	

Step	Location	Instructions	Remarks
e	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, perform the following steps: 1. Close TP16 and TP66. 2. Close TP22.	
f	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
g	CM-RCS (oxidizer panel)	Perform the following steps: 1. Remove G42MD5 and G42MD6 couplings from TP20 and TP70; connect to TP18 and TP68. NOTE Maintain TP18 and TP68 closed. 2. Open TP18 and establish flow of nitrogen through SYSTEM A oxidizer tank; maintain 8±2 psig at TP72 for a minimum of 6 minutes.	
h	CM-RCS (oxidizer panel)	After a minimum of 6 minutes, perform the following steps: 1. Close TP18. 2. Open TP22.	
i	CM-RCS (oxidizer panel)	Establish flow of nitrogen through oxidizer tanks by opening TP18 and TP68; maintain 8±2 psig at TP22 and TP72 for a minimum of 6 minutes.	
j	CM-RCS (oxidizer panel)	After a minimum of 6 minutes, close TP18 and TP68.	

Step	Location	Instructions	Remarks
k	CM-RCS (oxidizer panel)	Perform the following steps: 1. Remove G42MD5 and G42MD6 couplings from TP18 and TP68; connect to TP20 and TP70. NOTE Maintain TP20 and TP70 closed. 2. Verify isolation valves LV1 and LV3 are open.	
	S14-138 (RCS VALVE CONTROL panel)		
l	CM-RCS (oxidizer panel)	Establish a flow of nitrogen through oxidizer tanks by opening TP20 and TP70; maintain 8±2 psig at TP22 and TP72 for a minimum of 15 minutes.	
m	CM-RCS (oxidizer panel)	After a minimum of 15 minutes, close TP20 and TP70.	
n	S14-138 (PRESSURE panel)	Maintain 8±2 psig at TP22 and TP72 as indicated on RCS FILL gauge (G42PG1) while venting through oxidizer injector valves in step o.	
o	S14-138 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), set each pair of switches to OPEN for 2 minutes (maximum) and allow nitrogen to flow through engine injector valves. Actuate injector valves (close and open) at 15-second intervals during 2-minute intervals.	

Step	Location	Instructions	Remarks
		NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV1 and LV3.	

System	Sequence					
	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

p	S14-138 (RCS VALVE CONTROL panel)	Verify switches C19B1 through C19B12 are set to CLOSE.	
q	S14-138 (PRESSURE panel)	Increase nitrogen pressure to 40±2 psig at TP22 and TP72 by adjusting NITROGEN PURGE PRESSURE REGULATOR (G4PR2) as indicated on RCS FILL gauge (G42PG1).	
r	S14-138	Close G32MV3.	
s	CM-RCS (oxidizer panel)	Open TP20 and TP70.	
t	S14-138	Open G42MV4 and vent for 60 seconds.	
u	S14-138	After 60 seconds, close G42MV4.	

Step	Location	Instructions	Remarks
		NOTE • Attach tygon tubing to Hoke bottle, make ready to receive gas sample. • Obtain gas sample (minimum of 180 cubic inches) downstream of TP20 and TP70.	
v	S14-138	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent through Hoke bottle for 1 minute.	
w	S14-138	After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4.	
x	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
y	S14-138	Open G32MV3.	

Step	Location	Instructions	Remarks
z	S14-138 (Hoke bottle)	Label bottle TP20 and TP70, and specify N_2O_4 sample., NOTE • Gas sample shall be expedited to predesignated test facility for analysis. • Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume. • If gas sample N_2O_4 concentration exceeds 300 ppm, steps a through z shall be repeated.	

5-22. VACUUM DRY AND SHUTDOWN.

5-23. The purpose of these procedures is to reduce pressure within the oxidizer system, thereby boiling off any remaining freon not previously removed by nitrogen purging. With the system dry, and with 10±2-psig nitrogen pressure in the oxidizer tank, the system is ready for return shipment to the Contractor's facility and subsequent postflight inspection/analysis.

NOTE

If a-c power is not available and vacuum pump cannot be used, proceed to paragraph 5-25, step a.

5-24. VACUUM DRY. Vacuum dry procedures are performed as follows:

Step	Location	Instructions	Remarks
a	CM-RCS (oxidizer panel)	Close TP20 and TP70.	
b	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	CM-RCS S14-138	Open TP16 and TP66, and reduce pressure (40 lbs static) at TP22 and TP72 to 0 (+2, -0) psig as indicated on RCS FILL gauge (G42PG1).	
d	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
e	CM-RCS (helium panel)	Open TP10 and TP60.	
f	S14-138 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and establish 5±2 psig at TP10 and TP60 as indicated by RCS HELIUM CHECK VALVE gauge (G4PG3).	

Step	Location	Instructions	Remarks
g	CM-RCS (oxidizer panel)	Close the following: 1. TP22 2. TP72 3. TP16 4. TP66	
h	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
i	S14-138 (interface panel)	Disconnect flex hose 95581 (G42FH2) from OXID LIQUID SIDE VENTS connection.	
j	S14-138 (interface panel)	Disconnect flex hose 95581 (G42FH4) from RCS OXID FILL connection and connect to OXID LIQUID SIDE VENTS connector.	
k	S14-138 (vacuum pump)	Manually rotate shaft of vacuum pump motor and verify presence of oil in vacuum pump sight glass.	
l	S14-138 (POWER CONTROL panel)	Set VACUUM PUMP switch to ON. Allow a 15-minute warmup period.	
m	S14-138 (on top of scrubber tank)	Close G45MV2.	
n	S14-138 (VACUUM panel)	Open LIQUID TRAP TO RCS FILL valve (G50MV1), LIQUID TRAP TO VACUUM PUMP valve (G50MV2) and VACUUM BREAKER (G50MV3).	
o	CM-RCS (oxidizer panel)	Open TP16 and TP66.	
p	S14-138 (PRESSURE panel)	Evacuate system until 22 (+2.0, -0.0) inches of mercury absolute is indicated on RCS FILL gauge (G42PG1). Maintain vacuum for 30 minutes.	
q	CM-RCS (oxidizer panel)	After 30 minutes, close TP16 and TP66.	

Step	Location	Instructions	Remarks
r	S14-138 (VACUUM panel)	Close LIQUID TRAP TO RCS FILL valve (G50MV1), LIQUID TRAP TO VACUUM PUMP valve (G50MV2) and VACUUM BREAKER (G50MV3).	
s	S14-138 (POWER CONTROL panel)	Set VACUUM PUMP switch to OFF.	
t	S14-138 (on top of scrubber tank)	Open G45MV2.	
u	CM-RCS (helium panels)	Close TP10 and TP60.	
v	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
w	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
x	S14-138 (PRESSURE panel)	Crack NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 0 (+2, -0) psig.	
y	CM-RCS (oxidizer panel)	To establish a nitrogen pressure of 0 (+2, -0) psig inside oxidizer tanks, open TP16 and TP66.	
z	S14-138 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
aa	CM-RCS S14-138	Open oxidizer vent valve coupling TP14 and TP64, and reduce pressure at helium check valve ports TP10 and TP60 to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	

5-25. CM-RCS AND S14-138 SHUTDOWN. Shutdown procedures are performed as follows:

Step	Location	Instructions	Remarks
a	S14-138 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and establish nitrogen flow through drain vent couplings TP16 and TP66 until a static pressure of 10±2 psig is obtained as indicated by RCS FILL gauge (G42PG1).	
b	CM-RCS	Close TP16 and TP66.	
c	CM-RCS	Close TP14 and TP64.	
d	S14-138	Secure K-bottles (five).	
e	S14-138 (VENT panel)	Open FROM RCS FILL valve (G42MV5).	
f	S14-138 (PRESSURE panel)	Open FREON TANK PRESSURE REGULATOR (G4PR1).	
g	S14-138 (PRESSURE panel) (VENT panel)	When RCS FILL gauge (G42PG1) indicates zero pressure, proceed as follows: 1. Close FROM RCS FILL valve (G42MV5). 2. Close FREON TANK PRESSURE REGULATOR (G4PR1). NOTE Step g completes CM-RCS oxidizer system deactivation.	
h	S14-138 (VACUUM panel)	Open the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1)	

Step	Location	Instructions	Remarks
		2. LIQUID TRAP TO VACUUM PUMP (G50MV2) 3. TO VACUUM BREAKER (G50MV3).	
i	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
j	S14-138 (VENT panel)	Close FROM RCS VENT valve (G42MV3).	
k	S14-138 (NITROGEN PURGE panel)	Close to RCS FILL valve (G4MV2).	
l	S14-138 (VACUUM panel)	Close the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1) 2. LIQUID TRAP TO VACUUM PUMP (G50MV2) 3. TO VACUUM BREAKER (G50MV3).	
m	S14-138 (inside cart)	Close the following valves: 1. G32MV3 2. G45MV2.	
n	S14-138 (POWER CONTROL panel)	Set the following switches to OFF: 1. AC-DC EMERGENCY CONTROL 2. 115 VAC 3. 28 VDC POWER SUPPLY.	

Step	Location	Instructions	Remarks
		NOTE If BATTERY SUPPLY was used, set switch to OFF.	
o	CM-RCS	Disconnect all fluid lines and electrical connectors from CM.	
		NOTE Refer to section VIII for information relative to cleaning fluids and the cleaning of S14-138.	

5-26. STATUS CHARTS - VALVE POSITIONS

5-27. The following charts provide an instant checklist for determining valve positions during any portion of the individual deactivation procedures. These charts can be utilized as an aid during trouble analysis, or as a guide when attempting to ascertain the best place to establish a hold.

NORMAL MISSION S14-138

EXPULSION OF USABLE PROPELLANTS (OXIDIZER)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
G4PR1	X																								
G4PR2	X												O							X					
G4MV2	X																								
K-Bottles	X					O																			
G32MV1	X																								
G32MV2	X															O									
G32MV3	X																								
G32MV4	X															O									X
G42MV1	X																								
G42MV2	X																								
G42MV3	X																		O						
G42MV4	X																								
G42MV5	X											O					X								
G42MV6	X											O					X								
Ovbd Dump																									
G45MV2	X							O																	
G50MV1	X																								
G50MV2	X																								
G50MV3	X																								
TP10	X									O													X		
TP60	X								O													X			
TP14	X																	O						X	
TP64	X																	O						X	
TP16	X										O						X								
TP66	X										O						X								
TP18	X																								
TP68	X																								
TP20	X																								
TP70	X																								
TP22	X																								
TP72	X																								

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-138

NITROGEN PURGING (OXIDIZER REMOVAL)

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
G4PR1	X																					
G4PR2	X			O													X					
G4MV2	X	O																		X		
K-Bottles	O																					
G32MV1	X																				O	X
G32MV2	O																					X
G32MV3	X																					
G32MV4	X					O															X	
G42MV1	X																					
G42MV2	X																					
G42MV3	O				X																	
G42MV4	X																					
G42MV5	X																	O	X			
G42MV6	X						O			X												
Ovbd Dump																						
G45MV2	O																					
G50MV1	X																					
G50MV2	X																					
G50MV3	X																					
TP10	X																					
TP60	X																					
TP14	X																					
TP64	X																					
TP16	X							O	X													
TP66	X							O	X													
TP18	X										O	X										
TP68	X										O	X										
TP20	X														O	X						
TP70	X														O	X						
TP22	X			O																		
TP72	X			O																		

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION S14-138

FREON PURGING (DECONTAMINATION)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X			O																							X
G4PR2	X																										
G4MV2	X																										
K-Bottles	O																										
G32MV1	X																										
G32MV2	X																										
G32MV3	X	O																									
G32MV4	X																										
G42MV1	X		O																X								
G42MV2	X																				O					X	
G42MV3	X																										
G42MV4	X																										
G42MV5	X																										
G42MV6	X					O			X													O			X		
Ovbd Dump																											
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP10	X																										
TP60	X																										
TP14	X																						O				
TP64	X																						O				
TP16	X						O	X															O	X			
TP66	X						O	X															O	X			
TP18	X											O	X														
TP68	X									O	X	O	X														
TP20	X														O	X											
TP70	X														O	X											
TP22	O																			X							
TP72	O									X	O									X							

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-138

NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X																										
G4PR2	X				O			X	O						X		O							X			
G4MV2	X	O					X						O	X														
K-Bottles	O																										
G32MV1	X																										
G32MV2	X																										
G32MV3	O																	X					O				
G32MV4	X																										
G42MV1	X																										
G42MV2	X																										
G42MV3	X		O																								
G42MV4	X																		O	X	O	X					
G42MV5	X																										
G42MV6	X																										
Ovbd Dump	X																										
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP10	X								O		X						O									X	
TP60	X								O		X						O									X	
TP14	O									X						O											X
TP64	O									X						O											X
TP16	X																										
TP66	X																										
TP18	X																										
TP68	X																										
TP20	X																										
TP70	X																										
TP22	X			O																							
TP72	X			O																							

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION S14-138

NITROGEN PURGING AND SAMPLING (OXIDIZER SYSTEM)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	
G4PR1	X																											
G4PR2	X				O																				X			
G4MV2	X			O																								
K-Bottles	O																											
G32MV1	X																											
G32MV2	X																											
G32MV3	O																		X							O		
G32MV4	X																											
G42MV1	X																											
G42MV2	X																											
G42MV3	O		X																									
G42MV4	X																				O	X	O	X				
G42MV5	X																											
G42MV6	X		O				X																					
Ovbd Dump																												
G45MV2	O																											
G50MV1	X																											
G50MV2	X																											
G50MV3	X																											
TP10	X																											
TP60	X																											
TP14	X																											
TP64	X																											
TP16	X	O				X																						
TP66	X	O				X																						
TP18	X							O	X	O	X																	
TP68	X									O	X																	
TP20	X												O	X						O								
TP70	X												O	X						O								
TP22	O					X			O																			
TP72	O																											

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-138

VACUUM DRY

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																											
G4PR2	X						O																X		C			
G4MV2	O				X																			O				
K-Bottles	O																											
G32MV1	X																											
G32MV2	X																											
G32MV3	O																											
G32MV4	X																											
G42MV1	X																											
G42MV2	X																											
G42MV3	X																										O	
G42MV4	X																											
G42MV5	X																											
G42MV6	X		O						X																			
Ovbd Dump																												
G45MV2	O													X							O							
G50MV1	X														O				X									
G50MV2	X														O				X									
G50MV3	X														O				X									
TP10	X					O																X						
TP60	X					O																X						
TP14	X																											O
TP64	X																											O
TP16	X			O				X								O		X								O		
TP66	X			O				X								O		X								O		
TP18	X																											
TP68	X																											
TP20	O	X																										
TP70	O	X																										
TP22	O							X																				
TP72	O							X																				

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

NORMAL MISSION

S14-138

SHUTDOWN

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
G4PR1	X						O	X								
G4PR2	C	O								X						
G4MV2	O											X				
K-Bottles	O				X											
G32MV1	X															
G32MV2	X															
G32MV3	O													X		
G32MV4	X															
G42MV1	X															
G42MV2	X															
G42MV3	O										X					
G42MV4	X															
G42MV5	X					O		X								
G42MV6	X															
Ovbd Dump																
G45MV2	O													X		
G50MV1	X								O				X			
G50MV2	X								O				X			
G50MV3	X								O				X			
TP10	X															
TP60	X															
TP14	O			X												
TP64	O			X												
TP16	O		X													
TP66	O		X													
TP18	X															
TP68	X															
TP20	X															
TP70	X															
TP22	X															
TP72	X															

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

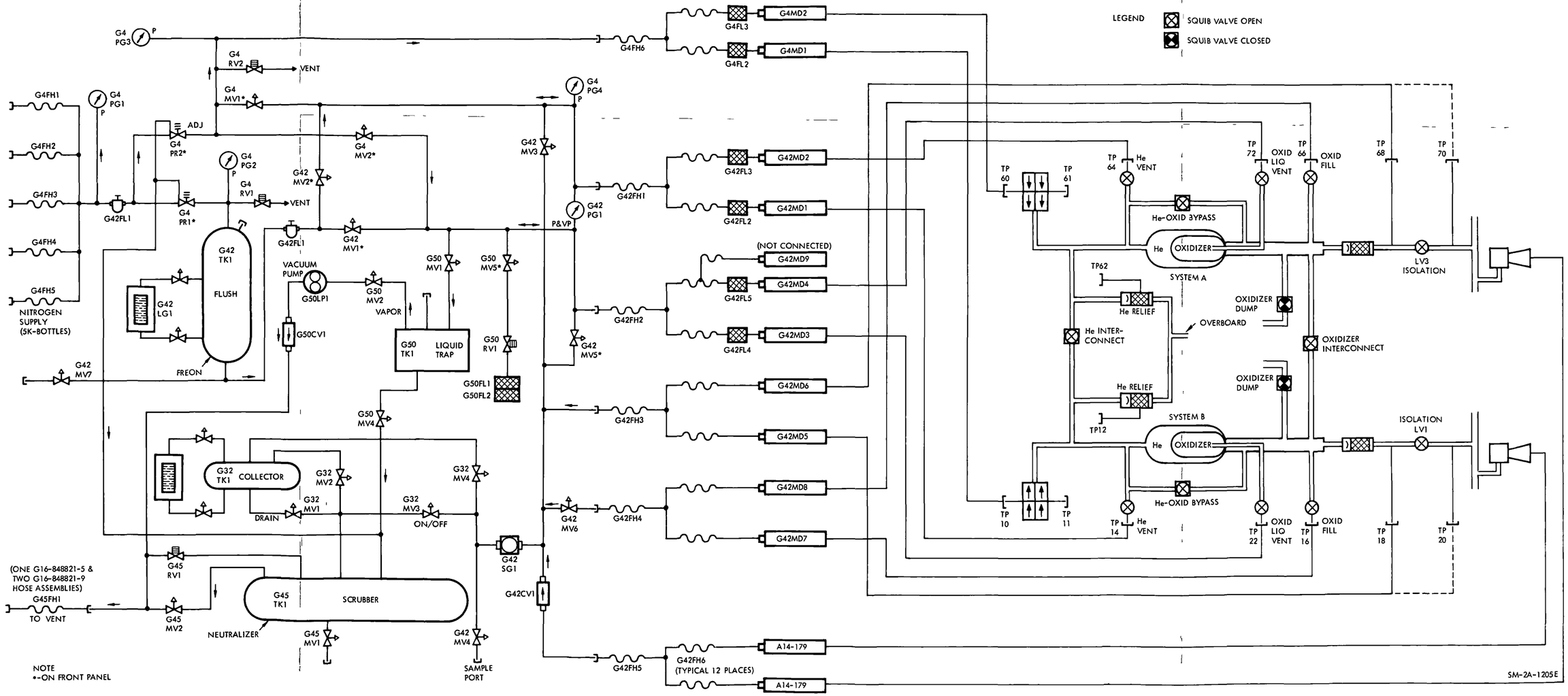


Figure 5-1 CM-GSE Fluid Line Interface—S14-138 (Normal Mission)

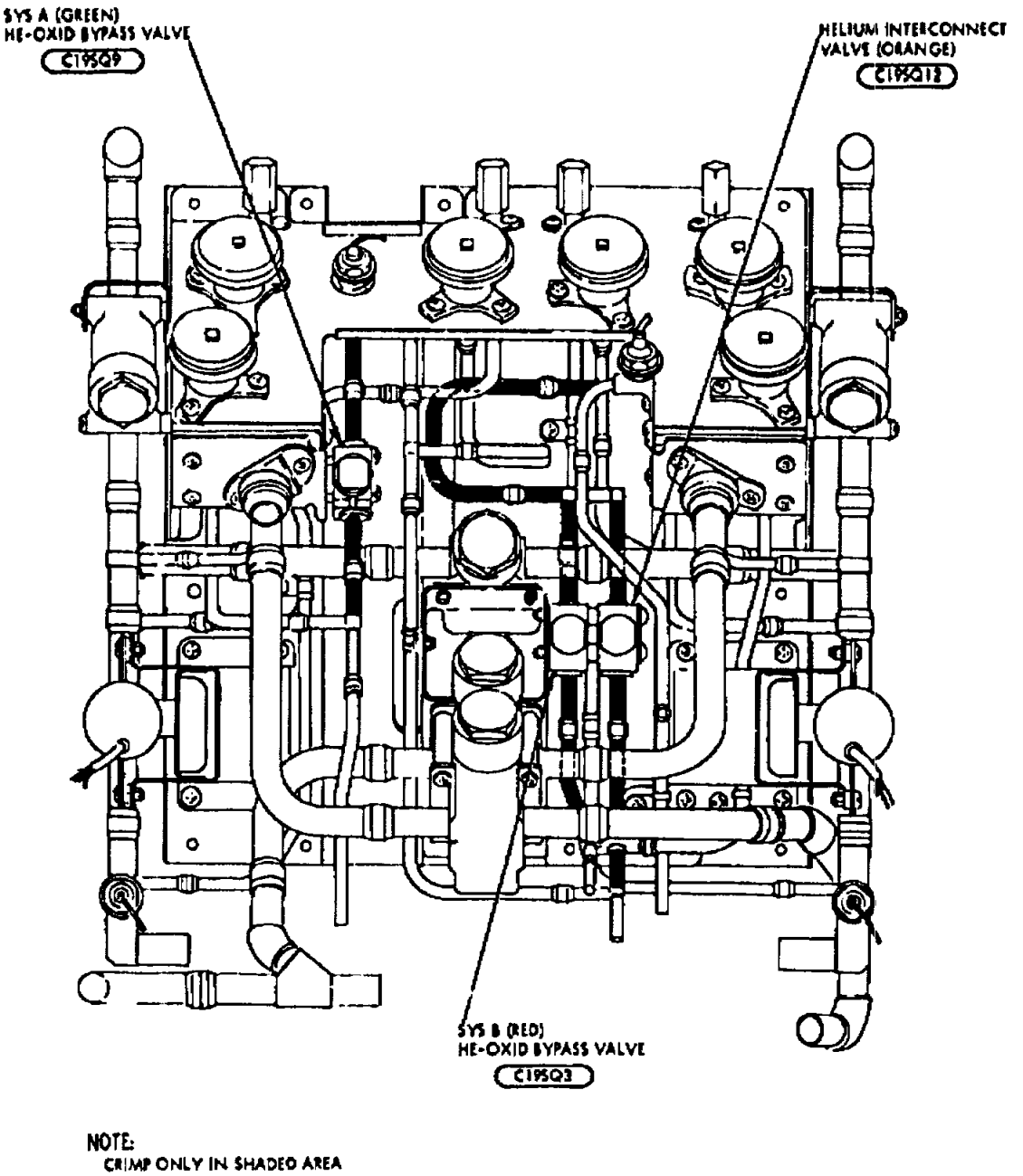


Figure 5-2. CM Oxidizer Panel Squib Valve Crimping Locations

SECTION VI

FUEL SYSTEM DEACTIVATION PROCEDURES FOR PAD OR LOW-ALTITUDE ABORT CONDITIONS

6-1. GENERAL

6-2. This section provides the procedures required to deactivate and prepare the fuel side of the CM-RCS for return shipment to the Contractor's facility. Procedural data, as presented within this section, is applicable to pad or low-altitude abort conditions, including worst case pad abort. Information relative to fuel system deactivation, following a normal or high-altitude abort, may be found in section IV.

6-3. CM-GSE ELECTRICAL INTERFACE—S14-137

6-4. For fuel system deactivation electrical hookup, see figure 9-1 and proceed as follows:

a. On S14-137, connect receptacle W4J1 of cable W4 (G16-848786) to plug P99 of CM C05W3 wiring harness (removed from J8 on C19A1 RCS control box).

b. Verify that plug W4P1 of cable W4 is connected to SYSTEM A ENGINE VALVES receptacle A3J3 on S14-137.

c. On S14-137, connect receptacle W5J1 of cable W5 (G16-880569-51) to plug P104 of CM C05W3 wiring harness (removed from J104 on CM C05W7 wiring harness.

d. Verify that plug W5P1 of cable W5 is connected to SYSTEM B ENGINE VALVES receptacle A3J4 on S14-137.

e. On S14-137, connect cable W3 (G16-848797-21) to CM terminal board C05TB20 as indicated in figures 9-1 and 9-2.

f. Verify that plug W3P1 of cable W3 is connected to FUEL ISOLATION VALVES receptacle A3J2 on S14-137.

NOTE

If 115-vac 60-cps facility power is not available at interim port, use battery sources supplied with S14-137 deactivation unit.

g. Verify that plug W2P2 of cable W2 (G16-848798-11) is connected to AC power receptacle A3J1 on S14-137.

h. Verify that plug W2P1 of cable W2 is connected to receptacle W1J1 of cable W1 (G16-848798-21).

i. Connect plug W1P1 of cable W1 to facility 115 vac 60 cps power.

6-5. CM-GSE FLUID LINE INTERFACE—S14-137

6-6. For fuel system deactivation fluid line hookup (pad or low-altitude abort), see figures 2-16 and 6-1, and proceed as follows:

NOTE

When handling flex lines, use care to prevent kinking.

a. Verify G4FH6 hose assembly (95625) is connected to RCS FUEL CHECK VALVES—HELIUM PANEL port on S14-137.

b. Connect G4MD1 coupling (ME144-0023-0041) of G4FH6 to helium check valve port TP8 on system B helium panel of CM.

c. Connect G4MD2 coupling (ME144-0023-0041) of G4FH6 to helium check valve port TP58 on system A helium panel of CM.

d. Verify G42FH1 hose assembly (95578) is connected to RCS FUEL VENT port on S14-137.

e. Connect G42MD1 coupling (ME273-0024-0002) of G42FH1 to system B HE VENT port TP15 on RCS fuel panel of CM.

f. Connect G42MD2 coupling (ME273-0024-0002) of G42FH1 to system A HE VENT port TP65 on RCS fuel panel of CM.

g. Verify G42FH2 hose assembly (95580) is connected to FUEL LIQUID SIDE VENTS port on S14-137.

h. Connect G42MD3 coupling (ME273-0021-0002) of G42FH2 to system B FUEL LIQ VENT port TP23 on RCS fuel panel of CM.

i. Obtain a sample of flushing fluid (alcohol) within flushing tank (G42TK1) by accomplishing the following steps:

1. Disconnect G42MD9 coupling from G42FH2 hose assembly.

2. Open G42MV1.

3. Position suitable container for securing sample.

4. Open K-bottles and crack G4PR1 until fluid flows from open end of G42FH2 hose assembly.

5. When sample has been taken, close G4PR1, K-bottles, and G42MV1.

6. Re-install G42MD9 coupling.

7. Store sample; then forward to predesignated test facility for analysis with gas sample obtained in paragraph 6-18, step u.

j. Connect G42MD4 coupling (ME273-0021-0002) of G42FH2 to system A FUEL LIQ VENT port TP73 on RCS fuel panel of CM.

NOTE

Verify G42MD9 coupling (ME273-0024-0002) and G16-848811-3 hose assembly are connected to 8R6BX-SS tee.

k. Verify G42FH3 hose assembly (G16-848826-3) is connected to TEST POINTS FUEL PANEL port on S14-137.

l. Connect G42MD5 coupling (ME144-0023-0041) of G42FH3 to system B test port TP19 on RCS fuel panel of CM.

m. Connect G42MD6 coupling (ME144-0023-0041) of G42FH3 to system A test port TP69 on RCS fuel panel of CM.

n. Verify G42FH4 hose assembly (95580) is connected to RCS FUEL FILL port on S14-137.

o. Verify flex hoses of G42MD7 and G42MD8 couplings are connected to G42FH4.

p. Connect G42MD7 coupling (ME273-0021-0002) of G42FH4 to system B FUEL FILL port TP17 on RCS fuel panel of CM.

q. Connect G42MD8 coupling (ME273-0021-0002) of G42FH4 to system A FUEL FILL port TP67 on RCS fuel panel of CM.

r. Verify G42FH5 hose assembly (G16-848824-3) is connected to RCS ENGINES port on S14-137.

s. Verify G42FH6 hose assembly (G16-848825-3) is connected to G42FH5 hose assembly (G16-848824-3).

t. See figures 3-13 and 9-5, and install A14-179 RCS adapters in the 12 RCS engines.

u. Connect installed A14-179 adapters (12) to parallel links of G42FH6 hose assembly.

v. Verify G45FH1 hose assembly (G16-848821-3) is connected to VENT port S14-137.

w. Connect both G16-848821-7 flex hose extensions and unions to G16-848821-3 hose assembly. (See figure 2-16.)

6-7. EXPULSION OF PROPELLANT WITHIN FUEL BLADDERS

6-8. During a pad or low-altitude abort, the CM will normally land with full fuel tanks; accordingly, the purpose of this procedure is to expel on-board fuel. Propellant expulsion is accomplished by compressing the teflon bladders (systems A and B), thereby expelling usable fuel into the S14-137 collector tank.

6-9. PROPELLANT EXPULSION PROCEDURES. To expel usable propellants from the fuel bladders, perform steps a through v.

NOTE

- Verify electrical and fluid line interface have been accomplished per paragraphs 6-3 and 6-5.
- Prior to proceeding further, unfold figure 6-1.

Step	Location	Instructions	Remarks
a	S14-137 (RCS POWER CONTROL panel)	Perform the following steps: NOTE If 115-vac 60-cps facility power is not available, leave 115 VAC-ON-OFF switch at OFF and set 28 VDC-BATTERY SUPPLY-CHARGE switch to BATTERY SUPPLY. 1. Verify VACUUM PUMP switch at OFF. 2. Set AC-DC EMERGENCY CONTROL switch to on (up). 3. Set 28 VDC-POWER SUPPLY-CHARGE switch to POWER SUPPLY. 4. Set 115 VAC-ON-OFF switch to ON; verify 115 VAC ON indicator lamp is lighted. CAUTION In case of an engine valve failure (engine valve HOLD OPEN indicator lamp comes on), close systems A and B isolation valves as follows: • Set systems A and B isolation valve reset switches to RESET. • Momentarily hold systems A and B ISOLATION VALVE switches to CLOSE. Verify CLOSED indicator lamps are lighted.	
	S14-137 (RCS VALVE CONTROL panel)		

Step	Location	Instructions	Remarks
b	S14-137 (RCS VALVE CONTROL panel)	Perform the following steps: 1. Verify system A and system B isolation valves (LV2 and LV4) are open. 2. Verify switches C19B1 through C19B12 are in CLOSE position. (Engine fuel valves closed.)	
c	CM-RCS (fuel panel)	Verify the following squib valve positions: 1. Helium interconnect open. 2. Helium dump open. 3. He-fuel bypass (2) closed. 4. Fuel interconnect closed. CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs.)	
d	CM-RCS (fuel panel)	Crimp helium dump line in close proximity to helium dump valve to prevent venting of pressurized nitrogen used to compress fuel bladders. (See figure 6-2.)	
		NOTE	
	CM-RCS (fuel panel)	If helium bypass squibs have fired, crimp helium bypass line in close proximity to bypass valves to isolate fuel from helium side of system.	

Step	Location	Instructions	Remarks
e	S14-137	Open all K-bottle valves (5).	
f	S14-137 (PRESSURE panel)	Verify NITROGEN SUPPLY gauge (G4PG1) indicates 1500 psig (minimum).	
g	S14-137 (top of scrubber tank)	Open G45MV2.	
h	CM-RCS (sys A, He panel)	Open TP58.	
i	CM-RCS (sys B, He panel)	Open TP8.	
j	CM-RCS (fuel panel)	Open TP17 and TP67.	
k	S14-137 (VENT panel)	Open the following valves: 1. FROM RCS FILL (G42MV5) 2. FROM RCS LIQUID SIDE VENT (G42MV6).	
l	S14-137 (PRESSURE panel)	Open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 10 (+0, -5) psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3). CAUTION If helium dump valve has not fired, helium system may still be pressurized to working pressure.	
m	S14-137 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 40±2 psig is indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	

Step	Location	Instructions	Remarks
n	S14-137 (PRESSURE panel)	Note and record pressure indication on RCS FILL gauge (G42PG1). Record:_____	
o	S14-137	Open the following valves: 1. G34MV2 2. G34MV4.	
p	S14-137 (PRESSURE panel)	When RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig, perform the following:	
	S14-137 (VENT panel)	1. Close FROM RCS FILL valve (G42MV5). 2. Close FROM RCS LIQUID SIDE VENT (G42MV6).	
	CM-RCS (fuel panel)	3. Close TP17 and TP67.	
q	CM-RCS (fuel panel)	Open TP15 and TP65; allow system to stabilize to 40 psig as indicated on RCS VENT gauge (G4PG4).	
r	S14-137 (VENT panel)	Open FROM RCS VENT valve (G42MV3) for a minimum of 60 seconds.	

Step	Location	Instructions	Remarks
s	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and reduce pressure at TP15 and TP65 to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	
t	S14-137	Note and record quantity of fuel within collector tank. Record: _____gallons.	
u	CM-RCS (sys A, He panel)	Close TP58.	
v	CM-RCS (sys B, He panel)	Close TP8.	

6-10. EXPULSION OF RESIDUAL FUEL

6-11. The purpose of this procedure is to clear the CM-RCS of residual fuel following removal of fuel within the bladders. In addition, the procedure shall also provide functional check of the injector valves associated with the fuel system.

6-12. RESIDUAL FUEL EXPULSION PROCEDURES. To expel residual fuel from the bladders, perform steps a through w.

Step	Location	Instructions	Remarks
a	CM-RCS	Verify A14-179 nozzle adapters installed in each engine nozzle. 1. Sys A +yaw 2. Sys B +yaw 3. Sys A CW 4. Sys A CCW 5. Sys A +pitch 6. Sys B +pitch 7. Sys A -pitch 8. Sys B -pitch 9. Sys B CW 10. Sys B CCW 11. Sys A -yaw 12. Sys B -yaw	
b	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	

Step	Location	Instructions	Remarks
c	CM-RCS (fuel panel)	Open TP23 and TP73.	
d	S14-137 (PRESSURE panel)	Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and pressurize system to 10±2 psig as indicated by RCS FILL gauge (G42PG1).	
e	CM-RCS (fuel panel) S14-137 (VENT panel)	After pressure has stabilized, close TP15, TP65, and FROM RCS VENT valve (G42MV3).	
f	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
g	CM-RCS (fuel panel)	Establish a nitrogen flow through fuel tanks by opening TP17 and TP67 while maintaining 10±2 psig at TP23 and TP73 for a minimum of 60 seconds.	
h	CM-RCS (fuel panel)	After a minimum of 60 seconds, close TP17 and TP67.	
i	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
j	CM-RCS	Establish a nitrogen flow through fuel tanks by opening TP19 and TP69 while maintaining 10±2 psig at TP23 and TP73 for a minimum of 60 seconds.	
k	CM-RCS (fuel panel)	After a minimum of 60 seconds, close TP19 and TP69.	
l	CM-RCS (fuel panel)	Remove G42MD5 and G42MD6 couplings from TP19 and TP69, connect TP21 and TP71. Maintain TP21 and TP71 closed.	

Step	Location	Instructions	Remarks
m	S14-137 (RCS VALVE CONTROL panel)	Verify isolation valves LV2 and LV4 are open.	
n	CM-RCS (fuel panel)	Establish a flow of nitrogen through fuel tanks by opening TP21 and TP71 while maintaining 10±2 psig at TP23 and TP73 for a minimum of 60 seconds.	
o	CM-RCS (fuel panel)	After a minimum of 60 seconds, close TP21 and TP71.	
p	CM-RCS (fuel panel)	Maintain 10±2 psig nitrogen pressure at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), while venting through fuel injector valves activated in step q.	
q	S14-137 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12 - in pairs, according to the following sequence), set each pair to OPEN for 60 seconds; then set to close. Verify that respective HOLD OPEN indicator lamp lights within 5 to 15 seconds after each engine valve switch is set to OPEN. NOTE • If a HOLD OPEN indicator lamp goes out before engine valve switch is set to CLOSE recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV2 and LV4.	

Step	Location	Instructions	Remarks

System	Sequence 1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

r	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
s	S14-137 (VENT panel)	Open FROM RCS FILL valve (G42MV5) until RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig.	
t	S14-137 (VENT panel)	When RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig, close G42MV5.	
u	S14-137 (NITROGEN PURGE panel)	Close to RCS FILL valve (G4MV2).	
v	S14-137	Perform the following steps: 1. Close G34MV4. 2. Note amount of fuel in collector tank. Record: _____gallons 3. Open G34MV1; drain fuel into scrubber tank.	
w	S14-137	When collector tank is empty, perform the following: 1. Close G34MV1. 2. Close G34MV2.	

6-13. ALCOHOL PURGING (DECONTAMINATION)

6-14. The purpose of this procedure is to clean the entire RCS (fuel side) by purging with alcohol contained within the S14-137 flushing tank (G42TK1). Positive purging of the fuel side of the system is accomplished by directing pressurized alcohol (systematically) through the fuel tanks, test ports, and finally the engines, together with associated plumbing.

6-15. DECONTAMINATION PROCEDURES. To accomplish the fuel side decontamination procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	S14-137	Open G34MV3.	
b	S14-137 (ALCOHOL FLUSH panel)	Open TO RCS FILL valve (G42MV1).	
c	S14-137 (PRESSURE panel)	Slowly open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) to obtain 18±2 psig, indicated on ALCOHOL TANK gauge (G4PG2), and establish a flow of alcohol to fill fuel tanks through TP23 and TP73. NOTE Maintain 18±2 psig for 30 minutes.	
d	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
e	CM-RCS (fuel panel)	Establish alcohol flow through fuel tanks by opening TP17 and TP67; maintain 18±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
f	CM-RCS (fuel panel)	After a minimum of 10 minutes, close TP17 and TP67.	

Step	Location	Instructions	Remarks
g	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
h	CM-RCS (fuel panel)	Perform the following steps: 1. Remove G42MD5 and G42MD6 couplings from TP21 and TP71; and connect to TP19 and TP69. Maintain TP19 and TP69 closed. 2. Establish a flow of alcohol by opening TP19 and TP69; maintain 18±2 psig at TP23 and TP73, as indicated on RCS FILL gage (G42PG1), for a minimum of 10 minutes.	
i	CM-RCS (fuel panel)	After a minimum of 10 minutes, perform the following steps: 1. Close TP19 and TP69. 2. Remove G42MD5 and G42MD6 couplings from TP19 and TP69, connect to TP21 and TP71. Maintain TP21 and TP71 closed.	
	S14-137 (RCS VALVE CONTROL panel)	3. Verify isolation valves LV2 and LV4 are open.	
	CM-RCS (fuel panel)	4. Establish a flow of alcohol by opening TP21 and TP71; maintain 18±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	

Step	Location	Instructions	Remarks
j	CM-RCS (fuel panel)	After a minimum of 10 minutes, close TP21 and TP71.	
k	S14-137 (PRESSURE panel)	Maintain 18±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), while flowing alcohol through fuel injector valves in step l.	
l	S14-137 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12 - in pairs, according to the following sequence), separately set each pair of switches to open for 4 minutes and allow alcohol to flow through injector valves. Actuate engine injector valves (close and open) at 1-minute intervals during the 4-minute period.	
	S14-137 (RCS VALVE CONTROL panel)	NOTE • Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle the applicable switch. • In case of an engine valve failure, close systems A and B isolation valves.	

System	Sequence					
	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

Step	Location	Instructions	Remarks
m	S14-137 (RCS VALVE CONTROL panel)	Verify all switches (C19B1 through C19B12) are set to CLOSE.	
n	S14-137 (ALCOHOL FLUSH panel)	Close TO RCS FILL valve (G42MV1).	
o	CM-RCS (fuel panel)	Close TP23 and TP73.	
p	S14-137 (ALCOHOL FLUSH panel)	Open TO RCS VENT valve (G42MV2).	
q	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
r	CM-RCS (fuel panel)	Establish a flow of alcohol to helium side of subsystem by opening TP15 and TP65, and fill to static pressure of 18±2 psig as indicated by RCS VENT gauge (G4PG4). Simultaneously, vent the contaminated alcohol by opening TP17 and TP67; maintain 18±2 psig at TP15 and TP65.	
s	CM-RCS	After 30 minutes, close TP17, TP67, and TP65.	
t	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
u	CM-RCS	Perform the following steps: 1. Disconnect G42MD2 from TP65. 2. Connect G42MD9 coupling (ME273-0024-0002) to TP65.	

Step	Location	Instructions	Remarks
v	S14-137 (VENT panel)	Perform the following steps: 1. Open FROM RCS FILL valve (G42MV5) and TP65. 2. Establish a flow of alcohol by maintaining 18±2 psig at TP15 and 0 psig at TP65 for a minimum of 1 minute.	
w	CM-RCS (fuel panel)	After a minimum of 1 minute, close TP65 and FROM RCS FILL valve (G42MV5).	
x	CM-RCS (fuel panel)	Perform the following steps: 1. Disconnect G42MD9 from TP65. 2. Connect G42MD2 to TP65. 3. Open TP65.	
y	S14-137 (ALCOHOL FLUSH panel)	Close TO RCS VENT valve (G42MV2).	
z	S14-137 (PRESSURE panel)	Close ALCOHOL TANK PRESSURE REGULATOR (C4PR1).	

6-16. NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

6-17. The purpose of this procedure is to purge the helium side of the system, thereby removing any alcohol remaining from the preceding procedures. Upon completion of the purging operation, a gas sample is obtained through the S14-137 sampling valve (G42MV4).

NOTE

Concentration of MMH in gas sample shall not exceed 300 ppm by volume.

6-18. PURGING AND SAMPLING PROCEDURES. To accomplish the nitrogen purging and sampling procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
b	S14-137 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
c	CM-RCS	Open TP23 and TP73.	
d	S14-137 (PRESSURE panel)	Perform the following steps: 1. Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and fill fuel subsystem to static pressure of 8±2 psig as indicated by RCS FILL gauge (G42PG1). Simultaneously vent through TP15 and TP65. 2. Note and record pressure indication on RCS VENT gauge (G4PG4). Record: _____ 3. Maintain static condition for 15 minutes.	
e	S14-137 (PRESSURE panel)	Increase pressure at TP23 and TP73 to 30 psig by further opening NITROGEN PURGE PRESSURE REGULATOR (G4PR2) as indicated on RCS FILL gauge (G42PG1).	

Step	Location	Instructions	Remarks
f	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
g	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
h	CM-RCS S14-137 (PRESSURE panel)	Establish a flow of nitrogen by opening TP8 and TP58. Simultaneously, open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 8±2 psig is indicated on RCS HELIUM CHECK VALVE gauge (G4PG3) for a minimum of 10 minutes.	
i	CM-RCS	Following a 10-minute circulation period, close TP15 and TP65.	
j	CM-RCS (helium panels)	Close TP8 and TP58.	
k	S14-137 (PRESSURE panel)	Increase NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
l	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2), and increase pressure at TP23 and TP73 to 40±2 psig as indicated by RCS FILL gauge (G42PG1).	
m	S14-137 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
n	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
o	CM-RCS (fuel panel)	Open TP15 and TP65.	

Step	Location	Instructions	Remarks
p	CM-RCS (He panels) S14-137 (PRESSURE panel)	Open TP8 and TP58; simultaneously open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 36 psig at TP8 and TP58 as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
q	S14-137 (scrubber tank)	Close G34MV3.	
r	S14-137	Open G42MV4 and vent for 60 seconds.	
s	S14-137	After 60 seconds, close G42MV4. NOTE • Attach tygon tubing to Hoke bottle and prepare for sampling operation. • Obtain a gas sample (minimum of 180 cubic inches) downstream of TP15 and TP65.	
t	S14-137 (Hoke bottle)	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent for 1 minute.	
u	S14-137	After 1 minute, perform the following steps: 1. Close Hoke bottle outlet.	

Step	Location	Instructions	Remarks
		NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4.	
v	S14-137 (scrubber tank)	Open G34MV3.	
w	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and reduce pressure at TP15 and TP65 to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	
x	S14-137 (Hoke bottle)	Label TP15 and TP65, and specify MMH sample. NOTE • Gas sample will be expedited to predesignated test facility for analysis. • Concentration of MMH in gas sample shall not exceed 300 ppm by volume. • If gas sample MMH concentration exceeds 300 ppm, steps a through x shall be repeated.	
y	CM-RCS (helium panels)	Close TP8 and TP58.	
z	CM-RCS (fuel panel)	Close TP15 and TP65.	

6-19. NITROGEN PURGING AND SAMPLING (FUEL SIDE)

6-20. The purpose of this procedure is to purge the fuel side of the system with nitrogen, thereby removing any alcohol remaining from the alcohol purge operation (paragraph 6-13). Upon completion of the purging cycle, a gas sample shall be obtained through the S14-137 sampling valve (G42MV4).

NOTE

Concentration of MMH in gas sample shall not exceed 300 ppm by volume.

6-21. PURGING AND SAMPLING PROCEDURES. To accomplish the nitrogen purging and sampling procedures, perform steps a through w.

Step	Location	Instructions	Remarks
a	CM-RCS (fuel panel)	Open TP17 and TP67.	
b	S14-137 (VENT panel)	Perform the following steps: 1. Close FROM RCS VENT valve (G42MV3). 2. Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	S14-137 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
d	S14-137 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and establish a flow of nitrogen through fuel tanks; maintain 8±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
e	CM-RCS (fuel panel) S14-137 (VENT panel)	After a minimum of 10 minutes, perform the following steps: 1. Close TP17 and TP67. 2. Close G42MV6.	

Step	Location	Instructions	Remarks
f	CM-RCS (fuel panel)	Remove G42MD5 and G42MD6 couplings from TP21 and TP71; connect to TP19 and TP69. Maintain TP19 and TP69 closed.	
g	CM-RCS (fuel panel)	Establish a flow of nitrogen through fuel tanks by opening TP19 and TP69; maintain 3±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), for a minimum of 6 minutes.	
h	CM-RCS (fuel panel)	After a minimum of 6 minutes, perform the following steps:	
		1. Close TP19 and TP69.	
		2. Remove G42MD5 and G42MD6 couplings from TP19 and TP69; connect to TP21 and TP71. Maintain TP21 and TP71 closed.	
	S14-137 (RCS VALVE CONTROL panel)	3. Verify isolation valves LV2 and LV4 are open.	
i	CM-RCS (fuel panel)	Establish a flow of nitrogen through fuel tanks by opening TP21 and TP71; maintain 8±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), for a minimum of 15 minutes.	
j	CM-RCS (fuel panel)	After a minimum of 15 minutes, close TP21 and TP71.	
k	S14-137 (PRESSURE panel)	Maintain 8±2 psig at TP23 and TP73, as indicated on RCS FILL gauge (G42PG1), while venting through fuel injector valves in step 1.	

Step	Location	Instructions	Remarks
1	S14-137 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), separately set each pair of switches to open for 60 seconds, and allow nitrogen to flow through injector valves. Actuate engine injector valves (close and open) at 15-second intervals during the 60-second period. NOTE • Should HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV2 and LV4.	

	Sequence					
System	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

m	S14-137 (RCS VALVE CONTROL panel)	Verify switches C19B1 through C19B12 are set to CLOSE.	
n	S14-137 (PRESSURE panel)	Increase pressure to 40±2 psig at TP23 and TP73 by adjusting NITROGEN PURGE PRESSURE REGULATOR (G4PR2) as indicated on RCS FILL gauge (G42PG1).	

Step	Location	Instructions	Remarks
o	S14-137 (scrubber tank)	Close G34MV3.	
p	CM-RCS (fuel panel)	Open TP21 and TP71.	
q	S14-137	Open G42MV4 and vent for 60 seconds.	
r	S14-137	After 60 seconds, close G42MV4. NOTE • Attach tygon tubing to Hoke bottle and prepare to obtain sample. • Obtain gas sample (minimum of 180 cubic inches) downstream of TP21 and TP71.	
s	S14-137 (Hoke bottle)	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent for 1 minute.	
t	S14-137	After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet.	

Step	Location	Instructions	Remarks
		3. Close G42MV4.	
		4. Disconnect Hoke bottle.	
u	S14-137	Open G34MV3.	
v	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
w	Hoke bottle	Label TP21 and TP71, and specify MMH sample. NOTE • Gas sample shall be expedited to a predesignated test facility for analysis. • Concentration of MMH in sample shall not exceed 300 ppm by volume. • If gas sample MMH concentration exceeds 300 ppm, steps a through v shall be repeated.	

6-22. VACUUM DRY AND SHUTDOWN

6-23. The purpose of these procedures is to reduce the pressure within the fuel system, thereby boiling off any remaining alcohol not previously removed by nitrogen purging. With the system dry, and with 10±2-psig nitrogen pressure in the fuel tank, the system is ready for return shipment to the Contractor's facility and subsequent postflight inspection/analysis.

6-24. VACUUM DRY. To perform the vacuum dry procedures, proceed with steps a through z.

Step	Location	Instructions	Remarks
a	CM-RCS (fuel panel)	Close TP21 and TP71.	
b	S14-137 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	CM-RCS (fuel panel) S14-137 (PRESSURE panel)	Open TP17 and TP67, reduce pressure (40 lbs static) at TP23 and TP73 to 0 (+2, -0) psig as indicated on RCS FILL gauge (G42PG1).	
d	S14-137 (NITROGEN PURGE panel)	Close to RCS FILL valve (G4MV2).	
e	CM-RCS (He panel)	Open TP8 and TP58.	
f	S14-137 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), establish 5±2 psig at TP8 and TP58 as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
g	CM-RCS (fuel panel)	Close the following: 1. TP23 2. TP73 3. TP17 4. TP67	
h	S14-137 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	

Step	Location	Instructions	Remarks
i	S14-137 (interface panel)	Disconnect 95580 (G42FH2) flex hose from FUEL LIQUID SIDE VENT connection.	
j	S14-137 (interface panel)	Disconnect 95580 (G42FH4) flex hose from RCS FUEL FILL connection, and connect to FUEL LIQUID SIDE VENT connector.	
k	S14-137	Manually rotate shaft of vacuum pump motor and verify presence of oil in vacuum pump sight glass.	
l	S14-137 (POWER CONTROL panel)	Set VACUUM PUMP switch to ON, and allow a 15-minute warmup period.	
m	S14-137 (on top of scrubber tank)	Close G45MV2.	
n	S14-137 (VACUUM panel)	Perform the following steps: 1. Open LIQUID TRAP TO RCS FILL valve (G50MV1). 2. Open LIQUID TRAP TO VACUUM PUMP valve (G50MV2).	
o	S14-137 (fuel panel)	Open TP17 and TP67.	
p		Evacuate system until 27.4 (+0.5, -1.0) inches of vacuum is indicated on RCS FILL gauge (G42PG1). NOTE Maintain vacuum for 30 minutes.	
q	CM-RCS (fuel panel)	After 30 minutes, close TP17 and TP67.	

Step	Location	Instructions	Remarks
r	S14-137 (VACUUM panel)	Perform the following steps: 1. Close LIQUID TRAP TO RCS FILL valve (G50MV1). 2. Close LIQUID TRAP TO VACUUM PUMP valve (G50MV2).	
s	S14-137 (POWER CONTROL panel)	Set VACUUM PUMP switch to OFF.	
t	S14-137 (on top of scrubber tank)	Open G45MV2.	
u	CM-RCS (He panel)	Close TP8 and TP58.	
v	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
w	S14-137 (NITROGEN PURGE panel)	Open TO RCS VENT valve (G4MV2).	
x	S14-137 (PRESSURE panel)	Crack NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 0 (+2, -0) psig.	
y	CM-RCS (fuel panel)	Open TP17 and TP67 to establish 0 (+2, -0) psig inside fuel tanks as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
z	S14-137 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
aa	CM-RCS (fuel panel)	Open TP15 and TP65 to reduce pressure, at TP8 and TP58, to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	

6-25. CM-RCS and S14-137 SHUTDOWN. To perform the shutdown procedures, proceed with steps a through n.

Step	Location	Instructions	Remarks
a	S14-137 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and establish nitrogen flow through drain vent couplings TP17 and TP67 until a static pressure of 10±2 psig is obtained as indicated on RCS FILL gauge (G42PG1).	
b	CM-RCS (fuel panel)	Close TP17, TP67, TP15, and TP65.	
c	S14-137	Secure K-bottles (5).	
d	S14-137 (VENT panel)	Open FROM RCS FILL valve (G42MV5).	
e	S14-137 (PRESSURE panel)	Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1).	
f	S14-147 (PRESSURE panel)	When RCS FILL gauge (G42PG1) indicates zero pressure, proceed as follows: 1. Close FROM RCS FILL valve (G42MV5). 2. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1). NOTE Step f completes CM-RCS fuel system deactivation.	
g	S14-137 (VACUUM panel)	Open the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1) 2. LIQUID TRAP TO VACUUM PUMP (G50MV2) 3. TO VACUUM BREAKER (G50MV3).	

Step	Location	Instructions	Remarks
h	S14-137 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
i	S14-137 (VENT panel)	Close FROM RCS VENT valve (G42MV3).	
j	S14-137 (NITROGEN PURGE panel)	Close to RCS FILL valve (G4MV2).	
k	S14-137 (VACUUM panel)	Close the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1) 2. LIQUID TRAP TO VACUUM PUMP (G50MV2) 3. TO VACUUM BREAKER (G50MV3).	
l	S14-137	Close the following valves: 1. G34MV3 2. G45MV2.	
m	S14-137 (POWER CONTROL panel)	Set the following switches to OFF: 1. AC-DC EMERGENCY CONTROL 2. 115 VAC 3. 28 VDC POWER SUPPLY. NOTE If BATTERY SUPPLY was used, set to OFF.	
n	CM-RCS	Disconnect all fluid lines and electrical connectors from CM.	

Step	Location	Instructions	Remarks
		NOTE Refer to section VIII for information relative to cleaning and preparing deactivation units for return shipment to the Contractor's facility.	

6-26. STATUS CHARTS - VALVE POSITIONS

6-27. The following charts provide an instant checklist for determining valve positions during any portion of the individual deactivation procedures. These charts can be utilized as an aid during trouble analysis, or as a guide when attempting to ascertain the best place to establish a hold.

LOW-ALTITUDE ABORT S14-137

EXPULSION OF PROPELLANT WITHIN FUEL BLADDERS

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
G4PR1	X																						
G4PR2	X												O							X			
G4MV2	X																						
K-Bottles	X					O																	
G34MV1	X																						
G34MV2	X															O							
G34MV3	X																						
G34MV4	X															O							
G42MV1	X																						
G42MV2	X																						
G42MV3	X																		O				
G42MV4	X																						
G42MV5	X											O					X						
G42MV6	X											O					X						
G45MV2	X							O															
G50MV1	X																						
G50MV2	X																						
G50MV3	X																						
TP8	X									O													X
TP58	X								O													X	
TP15	X																		O				
TP65	X																		O				
TP17	X										O							X					
TP67	X										O							X					
TP19	X																						
TP69	X																						
TP21	X																						
TP71	X																						
TP23	X																						
TP73	X																						

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

S14-137

EXPULSION OF RESIDUAL FUEL

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
G4PR1	X																							
G4PR2	X				O														X					
G4MV2	X		O																			X		
K-Bottles	O																							
G34MV1	X																						O	X
G34MV2	O																							X
G34MV3	X																							
G34MV4	O																						X	
G42MV1	X																							
G42MV2	X																							
G42MV3	O					X																		
G42MV4	X																							
G42MV5	X																			O	X			
G42MV6	X						O			X														
G45MV2	O																							
G50MV1	X																							
G50MV2	X																							
G50MV3	X																							
TP8	X																							
TP58	X																							
TP15	O					X																		
TP65	O					X																		
TP17	X							O	X															
TP67	X							O	X															
TP19	X										O	X												
TP69	X										O	X												
TP21	X														O	X								
TP71	X														O	X								
TP23	X			O																				
TP73	X			O																				

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT
ALCOHOL PURGING (DECONTAMINATION)

S14-137

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X			O																							X
G4PR2	X																										
G4MV2	X																										
K-Bottles	O																										
G34MV1	X																										
G34MV2	X																										
G34MV3	X	O																									
G34MV4	X																										
G42MV1	X		O												X												
G42MV2	X																O									X	
G42MV3	X																										
G42MV4	X																										
G42MV5	X																						O	X			
G42MV6	X				O			X										O			X						
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP8	X																										
TP58	X																										
TP15	X																		O								
TP65	X																		O	X			O	X	O		
TP17	X					O	X												O	X							
TP67	X					O	X												O	X							
TP19	X								O	X																	
TP69	X								O	X																	
TP21	X									O	X																
TP71	X									O	X																
TP23	O															X											
TP73	O															X											

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT
NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

S14-137

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X																										
G4PR2	X				O			X	O						X		O							X			
G4MV2	X	O					X						O	X														
K-Bottles	O																										
G34MV1	X																										
G34MV2	X																										
G34MV3	O																	X					O				
G34MV4	X																										
G42MV1	X																										
G42MV2	X																										
G42MV3	X		O																								
G42MV4	X																		O	X	O	X					
G42MV5	X																										
G42MV6	X																										
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP8	X								O		X						O									X	
TP58	X								O		X						O									X	
TP15	O									X						O											X
TP65	O									X						O											X
TP17	X																										
TP67	X																										
TP19	X																										
TP69	X																										
TP21	X																										
TP71	X																										
TP23	X			O																							
TP73	X			O																							

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

NITROGEN PURGING AND SAMPLING (FUEL SIDE)

S14-137

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
G4PR1	X																							
G4PR2	X				O																		X	
G4MV2	X			O																				
K-Bottles	O																							
G34MV1	X																							
G34MV2	X																							
G34MV3	O															X						O		
G34MV4	X																							
G42MV1	X																							
G42MV2	X																							
G42MV3	O		X																					
G42MV4	X																							
G42MV5	X																O	X	O	X				
G42MV6	X		O			X																		
G45MV2	O																							
G50MV1	X																							
G50MV2	X																							
G50MV3	X																							
TP8	X																							
TP58	X																							
TP15	X																							
TP65	X																							
TP17	X	O				X																		
TP67	X	O				X																		
TP19	X							O	X															
TP69	X							O	X															
TP21	X									O	X					O								
TP71	X									O	X					O								
TP23	O																							
TP73	O																							

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

S14-137

VACUUM DRY

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																											
G4PR2	X						O																X		C			
G4MV2	O				X																			O				
K-Bottles	O																											
G34MV1	X																											
G34MV2	X																											
G34MV3	O																											
G34MV4	X																											
G42MV1	X																											
G42MV2	X																											
G42MV3	X																										O	
G42MV4	X																											
G42MV5	X																											
G42MV6	X		O							X																		
G45MV2	O													X							O							
G50MV1	X														O				X									
G50MV2	X														O				X									
G50MV3	X																											
TP8	X					O																X						
TP58	X					O																X						
TP15	X																											O
TP65	X																											O
TP17	X			O				X								O		X								O		
TP67	X			O				X								O		X								O		
TP19	X																											
TP69	X																											
TP21	O	X																										
TP71	O	X																										
TP23	O							X																				
TP73	O							X																				

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

SHUTDOWN

S14-137

		a	b	c	d	e	f	g	h	i	j	k	l	m	n
G4PR1	X					O	X								
G4PR2	C	O							X						
G4MV2	O										X				
K-Bottles	O			X											
G34MV1	X														
G34MV2	X														
G34MV3	O												X		
G34MV4	X														
G42MV1	X														
G42MV2	X														
G42MV3	O									X					
G42MV4	X														
G42MV5	X				O		X								
G42MV6	X														
G45MV2	O												X		
G50MV1	X							O				X			
G50MV2	X							O				X			
G50MV3	X							O				X			
TP8	X														
TP58	X														
TP15	O		X												
TP65	O		X												
TP17	O		X												
TP67	O		X												
TP19	X														
TP69	X														
TP21	X														
TP71	X														
TP23	X														
TP73	X														

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

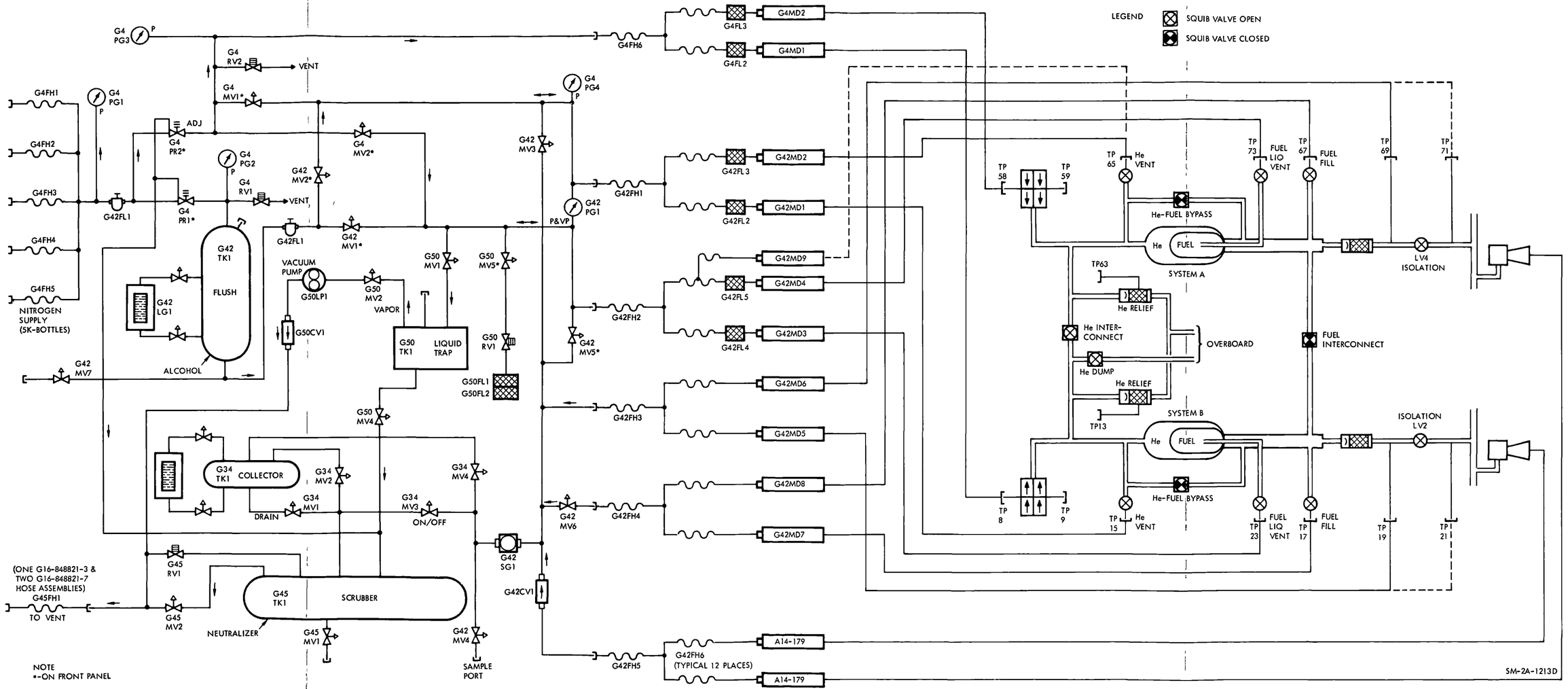


Figure 6-1 CM-GSE Fluid Line Interface—S14-137 (Low-Altitude Abort)

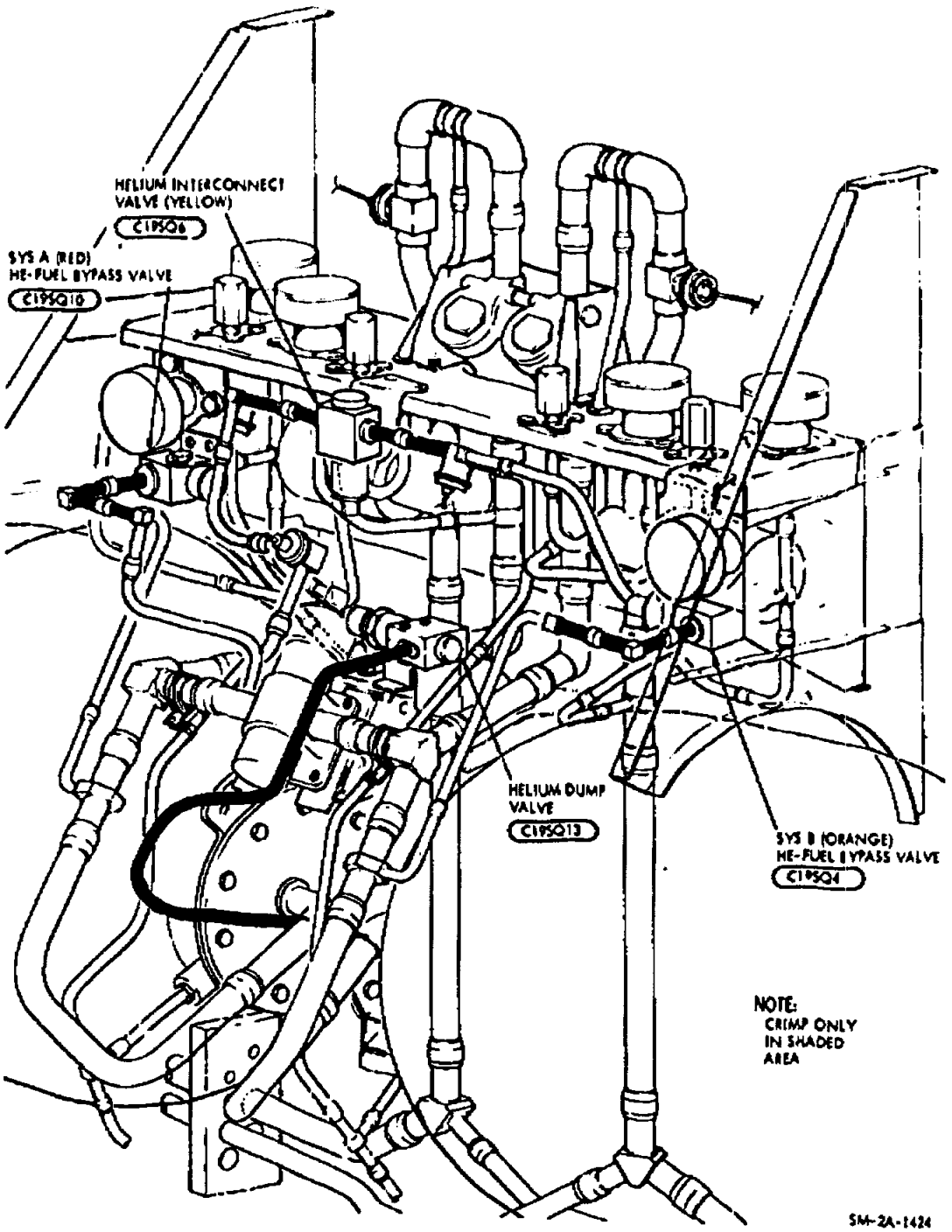


Figure 6-2. CM Fuel Panel Squib Valve Crimping Locations

SECTION VII

OXIDIZER SYSTEM DEACTIVATION PROCEDURES FOR PAD OR LOW-ALTITUDE ABORT CONDITIONS

7-1. GENERAL

7-2. This section provides the procedures required to deactivate and prepare the oxidizer side of the CM-RCS for return shipment to the Contractor's facility. Procedural data, as presented within this section, is applicable to pad or low-altitude abort conditions, including worst case pad abort. Information relative to oxidizer system deactivation, following a normal or high-altitude abort, may be found in section V.

7-3. CM-GSE ELECTRICAL INTERFACE—S14-138

CAUTION

To prevent damage by any mixup in similar cables of the fuel and oxidizer units, make certain that all fuel cables are removed from the CM and stowed before hooking up oxidizer unit to CM.

7-4. For oxidizer system deactivation electrical hookup, see figure 9-3 and proceed as follows:

a. On S14-138, connect receptable W4J1 of cable W4 (G16-848789) to plug P99 of CM C05W3 wiring harness (removed from J8 on C19A1 RCS control box).

b. Verify that plug W4P1 of cable W4 is connected to SYSTEM A ENGINE VALVES receptable J3 on S14-138.

c. On S14-138, connect receptacle W5J1 of cable W5 (G16-880569-41) to plug P104 of CM C05W3 wiring harness (removed from J104 on CM C05W7 wiring harness.

d. Verify that plug W5P1 of cable W5 is connected to SYSTEM B ENGINE VALVES receptacle J4 on S14-138.

e. On S14-138, connect cable W3 (G16-848797-11) to CM terminal board C05TB21 as indicated on figures 9-3 and 9-4.

f. Verify that plug W3P1 of cable W3 is connected to oxidizer ISOLATION VALVE receptacle J2 on S14-138.

NOTE

If 115-vac 60-cps facility power is not available at interim port, use battery sources supplied with S14-138 deactivation unit.

g. Verify that plug W2P2 of cable W2 (G16-848798-11) is connected to AC POWER receptacle J1 on S14-138.

h. Verify that plug W2P1 of cable W2 is connected to receptacle W1J1 of cable W1 (G16-848798-21).

i. Connect plug W1P1 of cable W1 to facility 115 vac 60 cps power.

7-5. CM-GSE FLUID LINE INTERFACE—S14-138

CAUTION

To prevent damage by any mixup in identical and/or similar lines of the fuel and oxidizer units, make certain that all fuel lines are removed from A14-179 adapters on the CM and stowed before hooking up oxidizer unit to CM.

7-6. For oxidizer system deactivation fluid line hookup (pad or low-altitude abort), see figures 2-18 and 7-1, and proceed as follows:

NOTE

When handling flex lines, use care to prevent kinking.

a. Verify G4FH6 hose assembly (95625) is connected to RCS OXID CHECK VALVES—HELIUM PANEL port on S14-138.

b. Connect G4MD1 coupling (ME144-0023-0021) of G4FH6 to helium check valve port TP10 on system B helium panel of CM.

c. Connect G4MD2 coupling (ME144-0023-0021) of G4FH6 to helium check valve port TP60 on system A helium panel of CM.

d. Verify G42FH1 hose assembly (95579) is connected to RCS OXID VENT port on S14-138.

e. Connect G42MD1 coupling (ME273-0011-0002) of G42FH1 to system B HE VENT port TP14 on RCS oxidizer panel of CM.

f. Connect G42MD2 coupling (ME273-0011-0002) of G42FH1 to system A HE VENT port TP64 on RCS oxidizer panel of CM.

g. Verify G42FH2 hose assembly (95581) is connected to OXID LIQUID SIDE VENTS port on S14-138.

h. Connect G42MD3 coupling (ME273-0019-0002) of G42FH2 to system B OX LIQ VENT port TP22 on RCS oxidizer panel of CM.

i. Obtain a sample of flushing fluid (freon) within flushing tank (G42TK1) by accomplishing the following steps:

1. Disconnect G42MD9 coupling from G42FH2 hose assembly.

2. Open G42MV1.

3. Position suitable container for securing sample.

4. Open K-bottles and crack G4PR1 until fluid flows from open end of G42FH2 hose assembly.

5. When sample has been taken, close G4PR1, K-bottles and G42MV1.

6. Re-install G42MD9 coupling.

7. Store sample; then forward to predesignated test facility for analysis with gas sample obtained in paragraph 7-18, step u.

j. Connect G42MD4 coupling (ME273-0019-0002) of G42FH2 to system A OX LIQ VENT port TP72 on RCS oxidizer panel of CM.

NOTE

Verify G42MD9 coupling (ME273-0011-0002) and G16-848811-5 hose assembly are connected to 8R6BX-SS tee.

k. Verify G42FH3 hose assembly (G16-848826-5) is connected to TEST POINT OXID PANEL port on S14-138.

l. Connect G42MD5 coupling (ME144-0023-0021) of G42FH3 to system B test port TP18 on RCS oxidizer panel of CM.

m. Connect G42MD6 coupling (ME144-0023-0021) of G42FH3 to system A test port TP68 on RCS oxidizer panel of CM.

n. Verify G42FH4 hose assembly (95581) is connected to RCS OXID FILL port on S14-138.

o. Disconnect overboard dump flex hose connections (ME271-0003-0059 and ME271-0003-0060) at CM oxidizer panel.

p. Connect G42MD7 coupling (ME273-0021-0002) of G42FH4 to system B OXID FILL port TP16 on RCS oxidizer panel of CM.

q. Connect G42MD8 coupling (ME273-0021-0002) of G42FH4 to system A OXID FILL port TP66 on RCS oxidizer panel of CM.

r. Disconnect G42MD7 and G42MD8 coupling assemblies from G42FH4 flex hose (2 places), and replace with flex hoses G42FH9 and G42FH8 (G16-848613), respectively.

s. At CM oxidizer panel, connect M666000-12-0240 hose assemblies to overboard dump SC fittings (V16-470119) on CM oxidizer panel.

t. Connect flex hoses G42FH8 and G42FH9 to M666000-12-0240 hose assemblies.

u. At CM oxidizer panel, close manual shutoff valves in both overboard dump lines.

v. Verify G42FH5 hose assembly (G16-848824-5) is connected to RCS ENGINES port on S14-138.

w. Verify G42FH6 hose assembly (G16-848825-5) is connected to G42FH5 hose assembly (G16-848824-5).

x. See figures 3-3 and 9-5, and verify A14-179 RCS adapters are installed in the 12 RCS engines.

y. Connect A14-179 adapters (12) to parallel links of G42FH6 hose assembly.

z. Verify G45FH1 hose assembly (G16-848821-5) is connected to VENT port S14-138.

aa. Connect both G16-848821-9 flex hose extensions and unions to G16-848821-5 hose assembly. (See figure 2-18.)

7-7. EXPULSION OF PROPELLANT WITHIN OXIDIZER BLADDERS

7-8. Propellant expulsion is accomplished by compressing the teflon bladders (systems A and B), thereby expelling usable oxidizer into the S14-138 collector tank.

7-9. PROPELLANT EXPULSION PROCEDURES. To expel usable propellants from the oxidizer bladders, perform steps a through t.

NOTE

- Verify electrical and fluid line interface have been accomplished per paragraphs 7-3 and 7-5.
- Prior to proceeding further, unfold figure 7-1.

Step	Location	Instructions	Remarks
a	S14-138 (RCS POWER CONTROL panel)	Perform the following steps: NOTE If 115-vac 60-cps facility power is not available, leave 115 VAC-ON-OFF switch at OFF and set 28 VDC-BATTERY SUPPLY-CHARGE switch to BATTERY SUPPLY. 1. Verify VACUUM PUMP switch at OFF. 2. Set AC-DC EMERGENCY CONTROL switch to on (up). 3. Set 28 VDC-POWER SUPPLY-CHARGE switch to POWER SUPPLY. 4. Set 115 VAC-ON-OFF switch to ON; verify 115 VAC ON indicator lamp is lighted.	

Step	Location	Instructions	Remarks
		CAUTION In case of an engine valve failure (engine valve HOLD OPEN indicator lamp comes on), close systems A and B isolation valves as follows: • Set systems A and B isolation valve reset switches to RESET. • Momentarily hold systems A and B ISOLATION VALVE switches to CLOSE. Verify CLOSED indicator lamps are lighted.	
	S14-138 (RCS VALVE CONTROL panel)	5. Verify system A and system B isolation valves (LV1 and LV3) are open. 6. Verify switches C19B1 through C19B12 are in CLOSE position. (Engine oxidizer valves closed.)	
b	CM-RCS (oxidizer panel)	Verify the following squib valve positions: 1. Helium interconnect open. 2. Oxidizer dump (2) open. 3. He-oxidizer bypass (2) open. 4. Oxidizer interconnect open. CAUTION Use care when crimping to avoid line rupture. Apply crimping tool perpendicular to line. (Torque value 175 in.-lbs.)	

Step	Location	Instructions	Remarks
		NOTE If He-oxidizer bypass squibs have fires, crimp bypass line in close proximity to bypass valves to isolate oxidizer from helium side of system. (See figure 7-2.)	
c	S14-138	Open all K-bottle valves (5).	
d	S14-138 (PRESSURE panel)	Verify NITROGEN SUPPLY gauge (G4PG1) indicates 1500 psig (minimum).	
e	S14-138	Open G45MV2.	
f	CM-RCS (sys A, He panel)	Open TP60.	
g	CM-RCS (sys B, He panel)	Open TP10.	
h	CM-RCS (oxidizer panel)	Open oxidizer overboard dump valves.	
i	S14-138 (VENT panel)	Open the following valves: 1. FROM RCS FILL (G42MV5). 2. FROM RCS LIQUID SIDE VENT (G42MV6).	
j	S14-138 (PRESSURE panel)	Open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 10(+0, -5) psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
k	S14-138 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) for static pressure of 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	

Step	Location	Instructions	Remarks
l	S14-138 (PRESSURE panel)	Note and record pressure indication on RCS FILL gauge (G42PG1). Record: _____	
m	S14-138	Open the following valves: 1. G32MV2. 2. G32MV4.	
n	S14-138 (PRESSURE panel)	When RCS FILL gauge (G42PG1) indicates 0(+2, -0) psig, perform the following:	
	S14-138 (VENT panel)	1. Close FROM RCS FILL valve (G42MV5). 2. Close FROM RCS LIQUID SIDE VENT (G42MV6).	
	CM-RCS (oxidizer panel)	3. Close oxidizer overboard dump valves.	
o	CM-RCS (oxidizer panel)	Open TP14 and TP64; allow system to stabilize to 40 psig as indicated on RCS VENT gauge (G4PG4).	
p	S14-138 (VENT panel)	Open FROM RCS VENT valve (G42MV3) for a minimum of 60 seconds.	

Step	Location	Instructions	Remarks
q	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and reduce pressure at TP14 and TP64 to 0(+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	
r	S14-138	Note and record quantity of oxidizer within collector tank. Record: _____ gallons.	
s	CM-RCS (sys A, He panel)	Close TP60.	
t	CM-RCS (sys B, He panel)	Close TP10.	

7-10. EXPULSION OF RESIDUAL OXIDIZER

7-11. The purpose of this procedure is to remove all residual oxidizer from the CM-RCS. In addition, the procedure also provides a functional check of the injector valves associated with the oxidizer system.

7-12. RESIDUAL OXIDIZER EXPULSION PROCEDURES. To expel residual oxidizer from the bladders, perform steps a through aa.

Step	Location	Instructions	Remarks
a	CM-RCS	Verify A14-179 nozzle adapters installed in each engine nozzle. 1. Sys A +yaw 2. Sys B +yaw 3. Sys A CW 4. Sys A CCW 5. Sys A +pitch 6. Sys B +pitch 7. Sys A -pitch 8. Sys B -pitch 9. Sys B CW 10. Sys B CCW 11. Sys A -yaw 12. Sys B -yaw	

Step	Location	Instructions	Remarks
b	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
c	CM-RCS (oxidizer panel)	Open TP22 and TP72.	
d	S14-138 (PRESSURE panel)	Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and pressurize system to 8±2 psig as indicated by RCS FILL gauge (G42PG1).	
e	CM-RCS (oxidizer panel) S14-138 (VENT panel)	After pressure has stabilized, close TP14, TP64, and FROM RCS VENT valve (G42MV3).	
f	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
g	CM-RCS (oxidizer panel)	Establish a nitrogen flow through oxidizer tanks by opening overboard dump valves (2 places) while maintaining 8±2 psig at TP22 and TP72 for a minimum of 60 seconds.	
h	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close overboard dump valves.	
i	S14-138 (VENT panel)	Perform the following steps: 1. Close FROM RCS LIQUID SIDE VENT valve (G42MV6). 2. Disconnect G42FH8 and G42FH9 flex hose assemblies from G42FH4 flex hose (2 places). 3. Reconnect G42MD7 and G42MD8 couplings to G42FH4 flex hose (2 places).	

Step	Location	Instructions	Remarks
j	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
k	CM-RCS (oxidizer panel)	Open TP16 and TP66, and establish a flow of nitrogen through oxidizer tanks while maintaining 8±2 psig pressure at TP22 and TP72 for a minimum of 60 seconds.	
l	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close TP16 and TP66.	
m	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
n	CM-RCS	Establish a nitrogen flow through oxidizer tanks by opening TP18 and TP68 while maintaining 8±2 psig at TP22 and TP72 for a minimum of 60 seconds.	
o	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close TP18 and TP68.	
p	CM-RCS (oxidizer panel)	Remove G42MD5 and G42MD6 couplings from TP18 and TP68, connect TP20 and TP70. Maintain TP20 and TP70 closed.	
q	S14-138 (RCS VALVE CONTROL panel)	Verify isolation valves LV1 and LV3 are open.	
r	CM-RCS (oxidizer panel)	Establish a flow of nitrogen through oxidizer tanks by opening TP20 and TP70 while maintaining 8±2 psig at TP22 and TP72 for a minimum of 60 seconds.	
s	CM-RCS (oxidizer panel)	After a minimum of 60 seconds, close TP20 and TP70.	

Step	Location	Instructions	Remarks
t	CM-RCS (oxidizer panel)	Maintain 8±2 psig nitrogen pressure at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), while venting through oxidizer injector valves activated in step u.	
u	S14-138 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), set each pair to OPEN for 60 seconds; then set to close. Verify that respective HOLD OPEN indicator lamp lights within 5 to 15 seconds after each engine valve switch is set to OPEN. NOTE • If a HOLD OPEN indicator lamp goes out before engine valve switch is set to CLOSE, recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV1 and LV3.	

Sequence

System	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

Step	Location	Instructions	Remarks
v	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
w	S14-138 (VENT panel)	Open FROM RCS FILL valve (G42MV5) until RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig.	
x	S14-138 (VENT panel)	When RCS FILL gauge (G42PG1) indicates 0 (+2, -0) psig, close G42MV5.	
y	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
z	S14-138	Perform the following steps: 1. Close G32MV4. 2. Note amount of oxidizer in collector tank. Record: _____ gallons 3. Open G32MV1; drain oxidizer into scrubber tank.	
aa	S14-138	When collector tank is empty, perform the following: 1. Close G32MV1. 2. Close G32MV2.	

7-13. FREON PURGING (DECONTAMINATION)

7-14. The purpose of this procedure is to clean the entire RCS (oxidizer side) by purging with freon contained within the S14-138 flushing tank (G42TK1). Positive purging of the oxidizer side of the system is accomplished by directing pressurized freon (systematically) through the oxidizer tanks, test ports, and finally the engines, together with associated plumbing.

7-15. DECONTAMINATION PROCEDURES. To accomplish oxidizer decontamination, perform steps a through au.

Step	Location	Instructions	Remarks
a	S14-138	Open G32MV3.	
b	S14-138 (FREON FLUSH panel)	Open TO RCS FILL valve (G42MV1).	
c	S14-138 (PRESSURE panel)	Slowly open FREON TANK PRESSURE REGULATOR (G4PR1) to obtain 18±2 psig, indicated on FREON TANK gauge (G4PG2), and establish a flow of freon to fill oxidizer tanks through TP22 and TP72.	
d		Maintain 18±2 psig for 30 minutes.	
e	S14-138	Perform the following steps: 1. Disconnect G42MD7 and G42MD8 couplings from G42FH4 flex hose assembly (2 places). 2. Reconnect G42FH8 and G42FH9 flex hose assemblies to G42FH4 flex hose assembly (2 places).	
	CM-RCS (oxidizer panel)	3. Verify M666000-12-0240 hose assemblies are connected to overboard dump fittings (V16-470119).	

Step	Location	Instructions	Remarks
f	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
g	CM-RCS (oxidizer panel)	Open shutoff valves in oxidizer overboard dump lines.	
h		Establish flow of freon through oxidizer tanks by venting through oxidizer overboard dump outlets while maintaining 18±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
i		After a minimum of 10 minutes, close shutoff valves in oxidizer overboard dump lines.	
j	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
k	S14-138	Perform the following steps: 1. Disconnect G42FH8 and G42FH9 flex hose assemblies from G42FH4 flex hose assembly (2 places). 2. Reconnect G42MD7 and G42MD8 couplings to G42FH4 flex hose assembly (2 places).	
l	CM-RCS (oxidizer panel)	Verify that G42MD7 and G42MD8 couplings are connected to TP16 and TP66.	
m	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	

Step	Location	Instructions	Remarks
n	CM-RCS (oxidizer panel)	Establish freon flow through oxidizer tanks by opening TP16 and TP66; maintain 18±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
o	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, close TP16 and TP66.	
p	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
q	CM-RCS (oxidizer panel)	Remove G42MD5 and G42MD6 couplings from TP20 and TP70, and connect to TP18 and TP68. Maintain TP18 and TP68 closed.	
r	CM-RCS (oxidizer panel)	Close TP72.	
s		Establish flow of freon through oxidizer tank system B by opening TP68 while maintaining 18±2 psig at TP22, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
t		After minimum of 10 minutes, close TP68.	
u	CM-RCS (oxidizer panel)	Open TP72.	
v		Establish a flow of freon by opening TP18 and TP68; maintain 18±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
w	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, close TP18 and TP68.	

Step	Location	Instructions	Remarks
x	CM-RCS (oxidizer panel)	Remove G42MD5 and G42MD6 couplings from TP18 and TP68, connect to TP20 and TP70. Maintain TP20 and TP70 closed.	
y	S14-138 (RCS VALVE CONTROL panel)	Verify isolation valves LV1 and LV3 are open.	
z		Establish a flow of freon by opening TP20 and TP70; maintain 18±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
aa	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, close TP20 and TP70.	
ab		Maintain 18±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), while flowing freon through oxidizer injector valves in step ac.	
ac	S14-138 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), separately set each pair of switches to open for 8 minutes and allow freon to flow through injector valves. Actuate engine injector valves (close and open) at 1-minute intervals during the 8-minute period.	

Step	Location	Instructions	Remarks
	S14-138 (RCS VALVE CONTROL panel)	NOTE o Should a HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle the applicable switch. o In case of an engine valve failure, close system A and system B isolation valves LV1 and LV3.	

	Sequence					
System	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

ad	S14-138 (RCS VALVE CONTROL panel)	Verify all switches (C19B1 through C19B12) are set to CLOSE.	
ae	S14-138 (FREON FLUSH panel)	Close TO RCS FILL valve (G42MV1).	
af	CM-RCS (oxidizer panel)	Close TP22 and TP72.	
ag	S14-138 (FREON FLUSH panel)	Open TO RCS VENT valve (G42MV2).	
ah	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	

Step	Location	Instructions	Remarks
ai		Establish a flow of freon to helium side of subsystem by opening TP14 and TP64, and fill to static pressure of 18±2 psig as indicated by RCS VENT gauge (G4PG4). Simultaneously, vent the contaminated freon by opening TP16 and TP66; maintain 18±2 psig at TP14 and TP64.	
aj	CM-RCS (oxidizer panel)	After 30 minutes, close TP16, TP66, and TP64.	
ak	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
al	CM-RCS (oxidizer panel)	Disconnect G42MD2 from TP64.	
am	CM-RCS	Connect G42MD9 (ME273-0011-0002) coupling to TP64.	
an	S14-138 (VENT panel)	Open FROM RCS FILL valve (G42MV5) and TP64.	
ao		Establish a flow of freon by maintaining 18±2 psig at TP14 and 0 psig at TP64 for a minimum of 1 minute.	
ap		After a minimum of 1 minute, close TP64 and FROM RCS FILL valve (G42MV5).	
aq	CM-RCS (oxidizer panel)	Disconnect G42MD9 from TP64.	
ar	CM-RCS (oxidizer panel)	Connect G42MD2 to TP64.	
as	CM-RCS (oxidizer panel)	Open TP64.	

Step	Location	Instructions	Remarks
at	S14-138 (FREON FLUSH panel)	Close TO RCS VENT valve (G42MV2).	
au	S14-138 (PRESSURE panel)	Close FREON TANK PRESSURE REGULATOR (G4PR1).	

7-16. NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

7-17. The purpose of this procedure is to purge the helium side of the system, thereby removing any freon remaining from the preceding procedures. Upon completion of the purging operation, a gas sample is obtained through the S14-138 sampling valve (G42MV4).

NOTE

Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume.

7-18. PURGING AND SAMPLING PROCEDURES. To accomplish the nitrogen purging and sampling procedures, perform steps a through z.

Step	Location	Instructions	Remarks
a	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	
b	S14-138 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	
c	CM-RCS	Open TP22 and TP72.	
d	S14-138 (PRESSURE panel)	Perform the following steps: 1. Slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and fill oxidizer subsystem to static pressure of 8±2 psig as indicated by RCS FILL gauge (G42PG1); simultaneously vent through TP14 and TP64. 2. Note and record pressure indication on RCS VENT gauge (G4PG4). Record:_____ 3. Maintain static condition for 15 minutes.	

Step	Location	Instructions	Remarks
e	S14-138 (PRESSURE panel)	Increase pressure at TP22 and TP72 to 30 psig by further opening NITROGEN PURGE PRESSURE REGULATOR (G4PR2) as indicated on RCS FILL gauge (G42PG1).	
f	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
g	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
h	CM-RCS (helium panels) S14-138 (PRESSURE panel)	Establish a flow of nitrogen by opening TP10 and TP60. Simultaneously, open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 8±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3) for a minimum of 10 minutes.	
i	CM-RCS (oxidizer panel)	Following a 10-minute circulation period, close TP14 and TP64.	
j	CM-RCS (helium panels)	Close TP10 and TP60.	
k	S14-138 (PRESSURE panel)	Increase NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 40±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
l	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2), and increase pressure at TP22 and TP72 to 40±2 psig as indicated by RCS FILL gauge (G42PG1).	
m	S14-138 NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
n	S14-138 PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	

Step	Location	Instructions	Remarks
o	CM-RCS (oxidizer panel)	Open TP14 and TP64.	
p	CM-RCS (He panels) S14-138 (PRESSURE panel)	Open TP10 and TP60; simultaneously open and adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to maintain 36 psig at TP10 and TP60 as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
q	S14-138 (scrubber tank)	Close G32MV3.	
r	S14-138	Open G42MV4 and vent for 60 seconds.	
s	S14-138	After 60 seconds, close G42MV4. NOTE • Attach tygon tubing to Hoke bottle and prepare for sampling operation. • Obtain a gas sample (minimum of 180 cubic inches) downstream of TP14 and TP64.	
t	S14-138 (Hoke bottle)	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent for 1 minute.	

Step	Location	Instructions	Remarks
u		After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4.	
v	S14-138 (scrubber tank)	Open G32MV3.	
w	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and reduce pressure at TP14 and TP64 to 0(+2, -0)psig as indicated on RCS VENT gauge (G4PG4).	
x	S14-138 (Hoke bottle)	Label TP14 and TP64, and specify N_2O_4 sample. NOTE Gas sample shall be expedited to a predesignated test facility for analysis.	
y	CM-RCS (helium panels)	Close TP10 and TP60.	
z	CM-RCS (oxidizer panel)	Close TP14 and TP64.	

7-19. NITROGEN PURGING AND SAMPLING (OXIDIZER SIDE)

7-20. The purpose of this procedure is to purge the oxidizer side of the system with nitrogen, thereby removing any freon remaining from the freon purge operation (paragraph 7-13). Upon completion of the purging cycle, a gas sample shall be obtained through the S14-138 sampling valve (G42MV4).

NOTE

Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume.

7-21. PURGING AND SAMPLING PROCEDURES. To accomplish the nitrogen purging and sampling procedures, perform steps a through aj.

Step	Location	Instructions	Remarks
a	CM-RCS and S14-138	Perform the following steps: 1. Disconnect G42MD7 and G42MD8 couplings from G42FH4 flex hose assembly (2 places). 2. Reconnect G42FH8 and G42FH9 flex hose assemblies to G42FH4 flex hose assembly (2 places). 3. Verify that G42FH8 and G42FH9 flex hose assemblies are connected to overboard dump lines connected to CM fittings (V16-470119).	
b	S14-138 (VENT panel)	Perform the following: 1. Close FROM RCS VENT valve (G42MV3). 2. Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	CM-RCS (oxidizer panel)	Open shutoff valves in oxidizer overboard dump lines.	
d	S14-138 (NITROGEN PURGE panel)	Open TO RCS FILL valve (G4MV2).	

Step	Location	Instructions	Remarks
e	S14-138 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and establish nitrogen flow through oxidizer tanks by venting through oxidizer overboard dump outlets; maintain 8±2 psig at TP22 and TP72, as indicated by RCS FILL gauge (G42PG1), for minimum of 4 minutes.	
f	CM-RCS	After minimum of 4 minutes, close shutoff valves in oxidizer overboard dump lines.	
g	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
h	CM-RCS and S14-138	Perform the following: 1. Disconnect G42FH8 and G42FH9 flex hose assemblies from G42FH4 flex hose assembly (2 places). 2. Reconnect G42MD7 and G42MD8 couplings to G42FH4 flex hose assembly (2 places). 3. Verify that G42MD7 and G42MD8 couplings are connected to TP16 and TP66.	
i	CM-RCS (oxidizer panel)	Open TP16 and TP66.	
j	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
k	S14-138 (PRESSURE panel)	Adjust NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and establish a flow of nitrogen through oxidizer tanks; maintain 8±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 10 minutes.	
l	CM-RCS (oxidizer panel)	After a minimum of 10 minutes, close TP16 and TP66.	

Step	Location	Instructions	Remarks
m	CM-RCS (oxidizer panel)	Close TP22.	
n	S14-138 (VENT panel)	Close FROM RCS LIQUID SIDE VENT valve (G42MV6).	
o	CM-RCS (oxidizer panel)	Remove couplings G42MD5 and G42MD6 from TP20 and TP70 and connect to TP18 and TP68. Maintain TP18 and TP68 closed.	
p	CM-RCS (oxidizer panel)	Open TP18 and establish a flow of nitrogen gas through oxidizer tank (SYSTEM A); maintain 8±2 psig at TP72 for a minimum of 6 minutes.	
q		After a minimum of 6 minutes, close TP18.	
r		Open TP22.	
s		Establish flow of nitrogen through oxidizer tanks by opening TP18 and TP68; maintain 8±2-psig pressure at TP22 and TP72 for a minimum of 6 minutes.	
t		After a minimum of 6 minutes, close TP18 and TP68.	
u	CM-RCS	Remove G42MD5 and G42MD6 couplings from TP18 and TP68; connect to TP20 and TP70. Maintain TP20 and TP70 closed.	
v	S14-138 (RCS VALVE CONTROL panel)	Verify isolation valves LV1 and LV3 are open.	
w	CM-RCS	Establish a flow of nitrogen through oxidizer tanks by opening TP20 and TP70; maintain 8±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), for a minimum of 15 minutes.	

Step	Location	Instructions	Remarks
x	CM-RCS (oxidizer panel)	After a minimum of 15 minutes, close TP20 and TP70.	
y	S14-138 (PRESSURE panel)	Maintain 8±2 psig at TP22 and TP72, as indicated on RCS FILL gauge (G42PG1), while venting through oxidizer injector valves in step z.	
z	S14-138 (RCS VALVE CONTROL panel)	Using SYSTEM A and SYSTEM B switches (C19B1 through C19B12, in pairs, according to the following sequence), separately set each pair of switches to open for 2 minutes (maximum) and allow nitrogen to flow through injector valves. Actuate engine injector valves (close and open) at 15-second intervals during the 2-minute period. NOTE • Should HOLD OPEN indicator lamp go out before engine valve switch is set to CLOSE, recycle applicable switch. • In case of an engine valve failure, close system A and system B isolation valves LV1 and LV3.	

Sequence

System	1	2	3	4	5	6
A	C19B11 -P	C19B9 +Y	C19B5 CW	C19B3 CCW	C19B7 +P	C19B1 -Y
B	C19B12 -P	C19B10 +Y	C19B2 -Y	C19B4 CCW	C19B6 CW	C19B8 +P

Step	Location	Instructions	Remarks
aa	S14-138 (RCS VALVE CONTROL panel)	Verify switches C19B1 through C19B12 are set to CLOSE.	
ab	S14-138 (PRESSURE panel)	Increase pressure to 40±2 psig at TP22 and TP72 by adjusting NITROGEN PURGE PRESSURE REGULATOR (G4PR2) as indicated on RCS FILL gauge (G42PG1).	
ac	S14-138 (scrubber tank)	Close G32MV3.	
ad	CM-RCS (oxidizer panel)	Open TP20 and TP70.	
ae	S14-138	Open G42MV4 and vent for 60 seconds.	
af	S14-138	After 60 seconds, close G42MV4.	
		NOTE • Attach tygon tubing to Hoke bottle and prepare to obtain sample. • Obtain gas sample (minimum of 180 cubic inches) downstream of TP20 and TP70.	
ag	314-138 Hoke bottle	Perform the following steps: 1. Open Hoke bottle outlet. 2. Open Hoke bottle inlet. 3. Open G42MV4. 4. Vent for 1 minute.	

Step	Location	Instructions	Remarks
ah		After 1 minute, perform the following steps: 1. Close Hoke bottle outlet. NOTE Obtain gas sample. 2. Close Hoke bottle inlet. 3. Close G42MV4. 4. Disconnect Hoke bottle.	
ai	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
aj	S14-138 (scrubber tank)	Open G32MV3 on/off valve.	
ak	Hoke bottle	Label TP20 and TP70, and specify N_2O_4 sample. NOTE • Gas sample shall be expedited to a predesignated test facility for analysis. • Concentration of N_2O_4 in gas sample shall not exceed 300 ppm by volume. • If gas sample N_2O_4 concentration exceeds 300 ppm, steps a through aj shall be repeated.	

7-22. VACUUM DRY AND SHUTDOWN

7-23. The purpose of these procedures is to reduce the pressure within the oxidizer system, thereby boiling off any remaining freon not previously removed by nitrogen purging. With the system dry, and with 10±2-psig nitrogen pressure in the oxidizer tank, the system is ready for return shipment to the Contractor's facility and subsequent postflight inspection/analysis.

7-24. VACUUM DRY. To perform the vacuum dry procedures, proceed with steps a through x.

Step	Location	Instructions	Remarks
a	CM-RCS (oxidizer panel)	Close TP20 and TP70.	
b	S14-138 (VENT panel)	Open FROM RCS LIQUID SIDE VENT valve (G42MV6).	
c	CM-RCS (oxidizer panel) S14-138 (PRESSURE panel)	Open TP16 and TP66, reduce pressure (40 lbs static) at TP22 and TP72 to 0 (+2, -0) psig as indicated on RCS FILL gauge (G42PG1).	
d	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
e	CM-RCS (He panel)	Open TP10 and TP60.	
f	S14-138 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig at TP10 and TP60 as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).	
g	CM-RCS (oxidizer panel)	Close TP22 and TP72.	

Step	Location	Instructions	Remarks
h	S14-138 (VENT panel)	Perform the following steps: 1. Close FROM RCS LIQUID SIDE VENT valve (G42MV6). 2. Disconnect 95881 (G42FH2) hose assembly from OXID LIQUID SIDE VENTS port. 3. Disconnect 95881 (G42FH4) hose assembly from RCS OXID FILL port and cap port. 4. Connect 95881 (G42FH4) hose assembly to OXID LIQUID SIDE VENTS port.	
i	S14-138	Manually rotate shaft of vacuum pump motor and verify presence of oil in vacuum pump sight glass.	
j	S14-138 (POWER CONTROL panel)	Set VACUUM PUMP switch to ON.	
k		Allow a 15-minute warmup period.	
l	S14-138 (on top of scrubber tank)	Close G45MV2.	
m	S14-138 (VACUUM panel)	Perform the following steps: 1. Open LIQUID TRAP TO RCS FILL valve (G50MV1). 2. Open LIQUID TRAP TO VACUUM PUMP valve (G50MV2). 3. Open VACUUM BREAKER (G50MV3).	
n		Evacuate system until 22 (+2, -0) inches of mercury absolute is indicated on RCS FILL gauge (G42PG1).	

Step	Location	Instructions	Remarks
o		Maintain vacuum for a minimum of 30 minutes.	
p	CM-RCS (oxidizer panel)	Close TP16 and TP66.	
q	S14-138 (VACCUM panel)	Perform the following steps: 1. Close LIQUID TRAP TO FILL FILL valve (G50MV1). 2. Close LIQUID TRAP TO VACUUM PUMP valve (G50MV2). 3. Close VACUUM BREAKER (G50MV3).	
r	S14-138 (POWER CONTROL panel)	Set VACUUM PUMP switch to OFF.	
s	S14-138 (on top of scrubber tank)	Open G45MV2.	
t	CM-RCS (helium panels)	Close TP10 and TP60.	
u	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
v	S14-138 (NITROGEN PURGE panel)	Open TO RCS VENT valve (G4MV2).	
w	S14-138 (PRESSURE panel)	Crack NITROGEN PURGE PRESSURE REGULATOR (G4PR2) to 0 (+2, -0) psig.	
x	CM-RCS	Open TP16 and TP66 to establish 0 (+2, -0) psig inside oxidizer tanks as indicated on G4PG3.	
y	S14-138 (VENT panel)	Open FROM RCS VENT valve (G42MV3).	

Step	Location	Instructions	Remarks
z	CM-RCS (oxidizer panel)	Open TP14 and TP64 to reduce pressure at TP10 and TP60 to 0 (+2, -0) psig as indicated on RCS VENT gauge (G4PG4).	

7-25. CM-RCS and S14-138 SHUTDOWN. To perform the shutdown procedures, proceed with steps a through n.

Step	Location	Instructions	Remarks
a	S14-138 (PRESSURE panel)	Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2), and establish nitrogen flow through drain vent couplings TP16 and TP66 until a static pressure of 10±2 psig is obtained as indicated on RCS FILL gauge (G42PG1).	
b	CM-RCS (oxidizer panel)	Close TP16, TP66, TP14, and TP64.	
c	S14-138	Secure K-bottles (5).	
d	S14-138 (VENT panel)	Open FROM RCS FILL valve (G42MV5).	
e	S14-138 (PRESSURE panel)	Open FREON TANK PRESSURE REGULATOR (G4PR1).	
f	S14-138 (PRESSURE panel)	When RCS FILL gauge (G42PG1) indicates zero pressure, proceed as follows: 1. Close FROM RCS FILL valve (G42MV5). 2. Close FREON TANK PRESSURE REGULATOR (G4PR1). NOTE Step f completes CM-RCS oxidizer system deactivation.	

Step	Location	Instructions	Remarks
g	S14-138 (VACUUM panel)	Open the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1). 2. LIQUID TRAP TO VACUUM PUMP (G50MV2). 3. TO VACUUM BREAKER (G50MV3).	
h	S14-138 (PRESSURE panel)	Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).	
i	S14-138 (VENT panel)	Close FROM RCS VENT valve (G42MV3).	
j	S14-138 (NITROGEN PURGE panel)	Close TO RCS FILL valve (G4MV2).	
k	S14-138 (VACUUM panel)	Close the following valves: 1. LIQUID TRAP TO RCS FILL (G50MV1). 2. LIQUID TRAP TO VACUUM PUMP (G50MV2). 3. TO VACUUM BREAKER (G50MV3).	
l	S14-138 (inside cart)	Perform the following steps: 1. Close G45MV2 valve. 2. Close G32MV3 on/off valve.	

Step	Location	Instructions	Remarks
m	S14-138 (POWER CONTROL panel)	Set the following switches to OFF: 1. AC-DC EMERGENCY CONTROL 2. 115 VAC 3. 28 VDC POWER SUPPLY. NOTE If BATTERY SUPPLY was used, set to OFF.	
n	CM-RCS	Disconnect all fluid lines and electrical connectors from CM. NOTE Refer to section VIII for information relative to cleaning and preparing deactivation units for return shipment to the Contractor's facility.	

7-26. STATUS CHARTS—VALVE POSITIONS

7-27. The following charts provide an instant checklist for determining valve positions during any portion of the individual deactivation procedures. These charts can be utilized as an aid during trouble analysis, or as a guide when attempting to ascertain the best place to establish a hold.

LOW-ALTITUDE ABORT S14-138

EXPULSION OF PROPELLANT WITHIN OXIDIZER BLADDERS

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
G4PR1	X																				
G4PR2	X										O							X			
G4MV2	X																				
K-Bottles	X				O																
G32MV1	X																				
G32MV2	X													O							
G32MV3	X																				
G32MV4	X													O							
G42MV1	X																				
G42MV2	X																				
G42MV3	X																O				
G42MV4	X																				
G42MV5	X									O					X						
G42MV6	X									O					X						
Ovbd Dump	X								O						X						
G45MV2	X					O															
G50MV1	X																				
G50MV2	X																				
G50MV3	X																				
TP10	X							O													X
TP60	X						O													X	
TP14	X															O					
TP64	X															O					
TP16	X																				
TP66	X																				
TP18	X																				
TP68	X																				
TP20	X																				
TP70	X																				
TP22	X																				
TP72	X																				

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT
EXPULSION OF RESIDUAL OXIDIZER

S14-138

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																											
G4PR2	X				O																		X					
G4MV2	X		O																							X		
K-Bottles	O																											
G32MV1	X																										O	X
G32MV2	O																											X
G32MV3	X																											
G32MV4	O																										X	
G42MV1	X																											
G42MV2	X																											
G42MV3	O					X																						
G42MV4	X																											
G42MV5	X																							O	X			
G42MV6	X						O			X	O			X														
Ovbd Dump	X							O	X																			
G45MV2	O																											
G50MV1	X																											
G50MV2	X																											
G50MV3	X																											
TP10	X																											
TP60	X																											
TP14	O					X																						
TP64	O					X																						
TP16	X											O	X															
TP66	X											O	X															
TP18	X														O	X												
TP68	X														O	X												
TP20	X																		O	X								
TP70	X																		O	X								
TP22	X			O																								
TP72	X			O																								

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT
FREON PURGING (DECONTAMINATION) (SHEET 1 OF 2)

S14-138

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X			O																								
G4PR2	X																											
G4MV2	X																											
K-Bottles	O																											
G32MV1	X																											
G32MV2	X																											
G32MV3	X	O																										
G32MV4	X																											
G42MV1	X		O																									
G42MV2	X																											
G42MV3	X																											
G42MV4	X																											
G42MV5	X																											
G42MV6	X						O				X			O			X											
Ovbd Dump	X							O		X																		
G45MV2	O																											
G50MV1	X																											
G50MV2	X																											
G50MV3	X																											
TP10	X																											
TP60	X																											
TP14	X																											
TP64	X																											
TP16	X														O	X												
TP66	X														O	X												
TP18	X																						O	X				
TP68	X																			O	X		O	X				
TP20	X																										O	X
TP70	X																										O	X
TP22	O																											
TP72	O																		X			O						

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT
FREON PURGING (DECONTAMINATION) (SHEET 2 OF 2)

S14-138

		a b	a c	a d	a e	a f	a g	a h	a i	a j	a k	a l	a m	a n	a o	a p	a q	a r	a s	a t	a u
G4PR1	O																				X
G4PR2	X																				
G4MV2	X																				
K-Bottles	O																				
G32MV1	X																				
G32MV2	X																				
G32MV3	O																				
G32MV4	X																				
G42MV1	O				X																
G42MV2	X						O												X		
G42MV3	X																				
G42MV4	X																				
G42MV5	X												O		X						
G42MV6	X							O			X										
Ovbd Dump	X																				
G45MV2	O																				
G50MV1	X																				
G50MV2	X																				
G50MV3	X																				
TP10	X																				
TP60	X																				
TP14	X								O												
TP64	X								O	X				O		X			O		
TP16	X								O	X											
TP66	X								O	X											
TP18	X																				
TP68	X																				
TP20	X																				
TP70	X																				
TP22	O					X															
TP72	O					X															

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

S14-138

NITROGEN PURGING AND SAMPLING (HELIUM SYSTEM)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X																										
G4PR2	X				O			X	O						X		O							X			
G4MV2	X	O					X						O	X														
K-Bottles	O																										
G32MV1	X																										
G32MV2	X																										
G32MV3	O																	X					O				
G32MV4	X																										
G42MV1	X																										
G42MV2	X																										
G42MV3	X		O																								
G42MV4	X																		O	X	O	X					
G42MV5	X																										
G42MV6	X																										
Ovbd Dump	X																										
G45MV2	O																										
G50MV1	X																										
G50MV2	X																										
G50MV3	X																										
TP10	X								O		X						O								X		
TP60	X								O		X						O								X		
TP14	O									X						O										X	
TP64	O									X						O										X	
TP16	X																										
TP66	X																										
TP18	X																										
TP68	X																										
TP20	X																										
TP70	X																										
TP22	X			O																							
TP72	X			O																							

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

S14-138

NITROGEN PURGING AND SAMPLING (OXIDIZER) (SHEET 1 OF 2)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																											
G4PR2	X					O																						
G4MV2	X				O																							
K-Bottles	O																											
G32MV1	X																											
G32MV2	X																											
G32MV3	O																											
G32MV4	X																											
G42MV1	X																											
G42MV2	X																											
G42MV3	O		X																									
G42MV4	X																											
G42MV5	X																											
G42MV6	X		O					X			O				X													
Ovbd Dump	X			O			X																					
G45MV2	O																											
G50MV1	X																											
G50MV2	X																											
G50MV3	X																											
TP10	X																											
TP60	X																											
TP14	X																											
TP64	X																											
TP16	X									O			X															
TP66	X									O			X															
TP18	X																O	X		O	X							
TP68	X																			O	X							
TP20	X																							O	X			
TP70	X																							O	X			
TP22	O													X					O									
TP72	O																											

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

S14-138

NITROGEN PURGING AND SAMPLING (OXIDIZER) (SHEET 2 OF 2)

		a b	a c	a d	a e	a f	a g	a h	a i	a j
G4PR1	X									
G4PR2	O								X	
G4MV2	O									
K-Bottles	O									
G32MV1	X									
G32MV2	X									
G32MV3	O		X							O
G32MV4	X									
G42MV1	X									
G42MV2	X									
G42MV3	X									
G42MV4	X				O	X	O	X		
G42MV5	X									
G42MV6	X									
Ovbd Dump	X									
G45MV2	O									
G50MV1	X									
G50MV2	X									
G50MV3	X									
TP10	X									
TP60	X									
TP14	X									
TP64	X									
TP16	X									
TP66	X									
TP18	X									
TP68	X									
TP20	X			O						
TP70	X			O						
TP22	O									
TP72	O									

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

S14-138

VACUUM DRY

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
G4PR1	X																										
G4PR2	X						O															X		C			
G4MV2	O				X																		O				
K-Bottles	O																										
G32MV1	X																										
G32MV2	X																										
G32MV3	O																										
G32MV4	X																										
G42MV1	X																										
G42MV2	X																										
G42MV3	X																									O	
G42MV4	X																										
G42MV5	X																										
G42MV6	X		O						X																		
Ovbd Dump	X																										
G45MV2	O												X							O							
G50MV1	X													O				X									
G50MV2	X													O				X									
G50MV3	X													O				X									
TP10	X					O															X						
TP60	X					O															X						
TP14	X																										
TP64	X																									O	
TP16	X			O													X									O	
TP66	X			O													X									O	
TP18	X																										
TP68	X																										
TP20	O	X																									
TP70	O	X																									
TP22	O							X																			
TP72	O							X																			

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

LOW-ALTITUDE ABORT

SHUTDOWN

S14-138

		a	b	c	d	e	f	g	h	i	j	k	l	m	n
G4PR1	X					O	X								
G4PR2	C	O							X						
G4MV2	O										X				
K-Bottles	O			X											
G32MV1	X														
G32MV2	X														
G32MV3	O												X		
G32MV4	X														
G42MV1	X														
G42MV2	X														
G42MV3	O									X					
G42MV4	X														
G42MV5	X				O		X								
G42MV6	X														
Ovbd Dump	X														
G45MV2	O												X		
G50MV1	X							O				X			
G50MV2	X							O				X			
G50MV3	X							O				X			
TP10	X														
TP60	X														
TP14	O		X												
TP64	O		X												
TP16	O		X												
TP66	O		X												
TP18	X														
TP68	X														
TP20	X														
TP70	X														
TP22	X														
TP72	X														

O - Open
X - Closed
C - Cracked

NOTE

All valves closed if not listed.

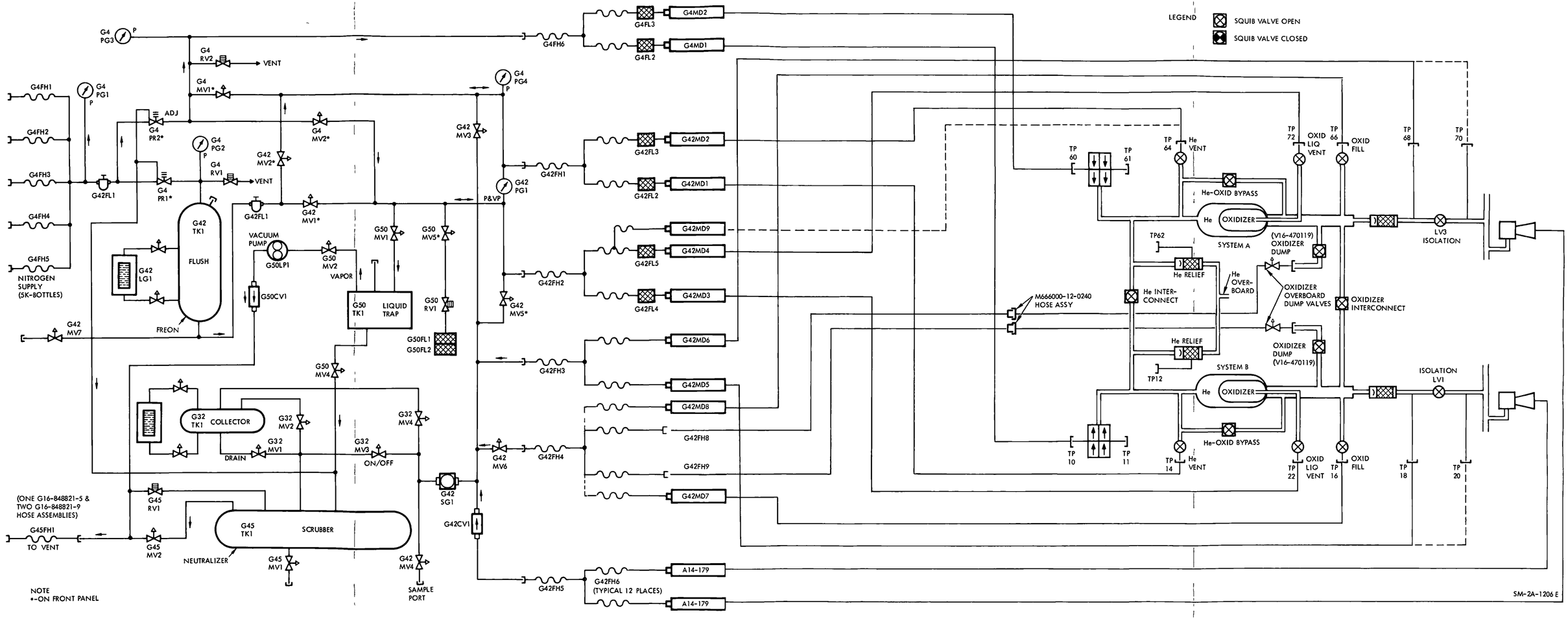


Figure 7-1 CM-GSE Fluid Line Interface—S14-138
(Low-Altitude Abort)

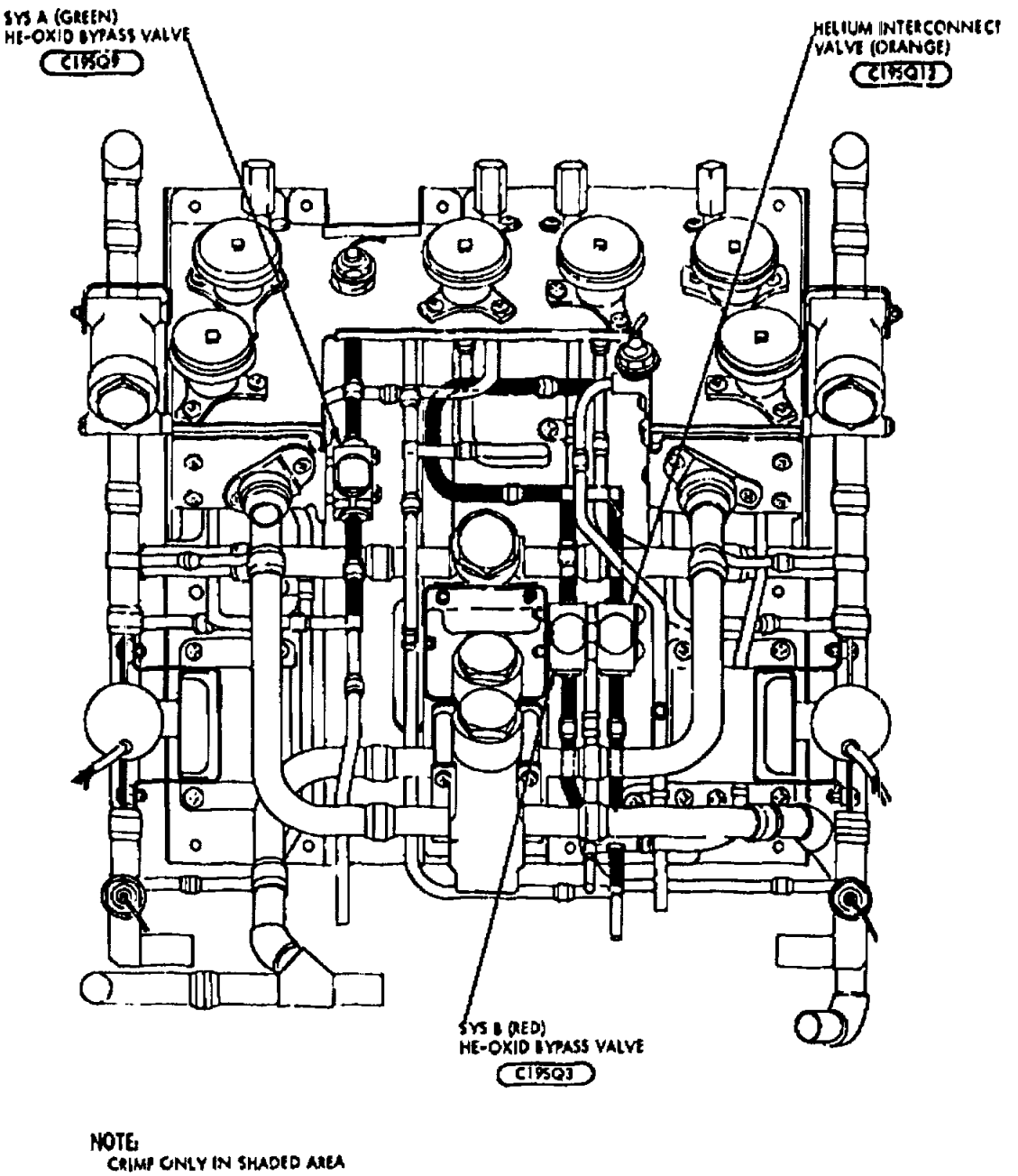


Figure 7-2. CM Oxidizer Panel Squib Valve Crimping Locations

SECTION VIII

S14-137/S14-138 CLEANING PROCEDURES

8-1. GENERAL

8-2. The purpose of this section is to provide cleaning procedures applicable to the deactivation units, and associated hardware. Immediately following completion of deactivation operations, LST members shall clean and make deactivation units ready for return shipment to the Contractor's facility.

8-3. FLEX HOSE COUPLINGS AND A14-179 NOZZLE ADAPTERS

8-4. Perform the following steps:

a. Disconnect all flex hose couplings.

b. Disconnect all A14-179 nozzle adapters.

c. Immediately following disconnection from the hose assemblies, immerse all couplings and adapters in the noted cleaning agent, blow dry, and bag for return shipment.

Couplings and Nozzle Adapters	Cleaning Agent
Used with S14-137	Alcohol
Used with S14-138	Freon

8-5. S14-137

8-6. Cleaning procedures are divided into two parts. Part one (steps a through by) covers the external fluid lines and fittings; part two (paragraph 8-7) covers the internal components of the unit. To prepare the S14-137 deactivation unit external fluid lines for return shipment, accomplish the following cleaning procedures:

a. Verify all valves and regulators are in the closed or off position, and the hookup configuration conforms with figure 8-1.

b. Position unit as necessary to facilitate draining of all liquids.

c. Open (G45MV2) vent valve to scrubber tank (G45TK1).

d. Open (G34MV1) drain valve to collector tank (G34TK1) and drain contents into scrubber tank.

NOTE

To expedite the draining process, the scrubber tank may be vented by opening the valve between the tank and the level gauge upper valve, or by opening collector tank fill valve (G34MV4); sampling valve (G42MV4) and removing cap from sampling fitting.

e. Close collector tank drain valve (G34MV1) and any valves opened for venting.

f. Open (G50MV4) drain valve to liquid trap (G50TK1) and drain contents into scrubber tank.

NOTE

To expedite the draining process, venting may be accomplished by loosening the plug on top of the tank.

g. Close liquid trap drain valve (G50MV4) and tighten cap on top of tank, if loosened.

h. Connect a length of tubing from suitable container to scrubber tank drain port.

i. Open drain valve (G45MV1) and drain contents of scrubber tank.

j. Close scrubber tank drain valve (G45MV1).

k. Service flushing tank (G42TK1) with alcohol. (Refer to paragraph 2-27.)

l. Open all K-bottle valves (5).

m. On PRESSURE panel, verify 1500 psig on NITROGEN SUPPLY gauge (G4PG1). (Remove and replace expended K-bottles as necessary.)

n. On PRESSURE panel, slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95625 flex hose (G4FH6) for 1 minute.

o. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

p. On interface panel, disconnect flex hose (G4FH6) from RCS FUEL CHECK VALVES—HELIUM PANEL port and cap ends.

q. On ALCOHOL FLUSH panel, open TO RCS VENT valve (G42MV2).

r. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) and establish flow of alcohol through 95578 flex hose (G42FH1) for 1 minute.

s. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

t. On ALCOHOL FLUSH panel, close TO RCS VENT valve (G42MV2).

u. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV1).

v. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95578 flex hose (G42FH1) for 1 minute.

w. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

x. On NITROGEN PURGE panel, close TO RCS VENT vlave (G4MV1).

y. On interface panel, disconnect flex hose (G42FH1) from RCS FUEL VENT port and cap ends.

z. On ALCOHOL FLUSH panel, open TO RCS FILL valve (G42MV1).

aa. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) and establish a flow of alcohol through 95580 flex hose (G42FH2) for 1 minute.

ab. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

ac. On ALCOHOL FLUSH panel, close TO RCS FILL valve (G42MV1).

ad. On NITROGEN PURGE panel, open TO RCS FILL valve (G4MV2).

ae. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95580 flex hose (G42FH2) for 1 minute.

af. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

ag. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

ah. On interface panel, disconnect flex hose (G42FH2) from FUEL LIQUID SIDE VENTS port and cap ends.

ai. On VENT panel, open FROM RCS FILL valve (G42MV5).

aj. On ALCOHOL FLUSH panel, open TO RCS FILL valve (G42MV1).

ak. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) and establish a flow of alcohol through flex hose (G42FH3) for 1 minute.

al. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

am. On ALCOHOL FLUSH panel, close TO RCS FILL valve (G42MV1).

an. On NITROGEN PURGE panel, open TO RCS FILL valve (G4MV2).

ao. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge G16-848826-3 flex hose (G42FH3) for 1 minute.

ap. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

aq. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

ar. On interface panel, disconnect flex hose (G42FH3) from TEST POINTS FUEL PANEL port and cap ends.

as. On VENT panel, open FROM RCS LIQUID SIDE VENT valve (G42MV6).

at. On ALCOHOL FLUSH panel, open TO RCS VENT valve (G42MV1).

au. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) and establish a flow of alcohol through flex hose (G42FH4) for 1 minute.

av. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

aw. On ALCOHOL FLUSH panel, close TO RCS VENT valve (G42MV1).

ax. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV2).

ay. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95580 flex hose (G42FH4) for 1 minute.

az. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

ba. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

bb. On VENT panel, close FROM RCS LIQUID SIDE VENT valve (G42MV6).

bc. On interface panel, disconnect flex hose (G42FH4) from RCS FUEL FILL port and cap ends.

bd. Disconnect G16-848824-3 hose assembly (G42FH5) from interface panel at RCS ENGINES port and reconnect it to RCS FUEL FILL port on interface panel.

NOTE

Prior to proceeding further, cap all hose/ A14-179 interface connectors; except the pair nearest the deactivation unit.

be. On VENT panel, open FROM RCS LIQUID SIDE VENT valve (G42MV6).

bf. On ALCOHOL FLUSH panel, open TO RCS VENT valve (G42MV1).

bg. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1) and establish a flow of alcohol through the nearest pair of G16-848825-3 engine hose assemblies (G42FH6) for 1 minute.

bh. On VENT panel, close FROM RCS LIQUID SIDE VENT valve (G42MV6).

bi. Remove caps from next (downstream) pair of connectors and reinstall on next nearest pair.

bj. Open FROM RCS LIQUID SIDE VENT valve (G42MV6) and establish a flow of alcohol for 1 minute.

bk. Repeat steps bh through bj until all lines are flushed with alcohol.

bl. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

bm. On ALCOHOL FLUSH panel, close TO RCS VENT valve (G42MV1).

bn. Remove caps from the nearest pair of engine hose assemblies and reinstall on last pair of lines flushed in steps bg through bk.

bo. On NITROGEN PURGE panel, open TO RCS FILL valve (G4MV2).

bp. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge nearest pair of G16-848825-3 engine hose assemblies (G42FH6) for 1 minute.

bq. On VENT panel, close FROM RCS LIQUID SIDE VENT valve (G42MV6).

br. Remove caps from next (downstream) pair of connectors and reinstall on next nearest pair.

bs. Open FROM RCS LIQUID SIDE VENT valve (G42MV6) and purge for 1 minute.

bt. Repeat steps bq through bs until all lines are purged with nitrogen.

bu. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

bv. Close FROM RCS LIQUID SIDE VENT valve (G42MV6).

bw. Close FROM FCS FILL valve (G42MV5).

bx. On NITROGEN PURGE PANEL, close TO RCS FILL valve (G4MV2).

by. Disconnect G16-848824-3 hose assembly (G42MV5) from interface panel at RCS FUEL FILL port and cap all connectors.

8-7. Complete S14-137 cleaning procedures by accomplishing the following steps:

a. Open fill valve (G34MV4) at collector tank (G34TK1).

b. On VENT panel, open FROM RCS VENT valve (G42MV3).

c. On ALCOHOL FLUSH panel, open TO RCS VENT valve (G42MV2).

d. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1); establish alcohol flow into collector tank, and fill collector tank with alcohol while monitoring fluid level on sight glass.

e. Open collector tank vent valve (G34MV2).

f. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

g. On ALCOHOL FLUSH panel, close TO RCS VENT valve (G42MV2).

h. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV1).

i. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).

j. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

k. Close TO RCS VENT valve (G4MV1).

l. On VENT panel, close FROM RCS VENT valve (G42MV3).

m. On VACUUM panel, open LIQUID TRAP TO RCS FILL valve (G50MV1).

n. On ALCOHOL FLUSH panel, open TO RCS FILL valve (G42MV1).

o. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1); adjust to 10 psig as indicated on ALCOHOL TANK gauge (G4PG2), and establish flow of alcohol into liquid trap (G50TK1) for 1 minute minimum.

p. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

q. Close LIQUID TRAP TO RCS FILL valve (G50MV1).

r. Open drain valve (G50MV4) and allow liquid trap to drain.

s. Close collector tank fill valve (G34MV4).

t. Close collector tank vent valve (G34MV2).

u. Open on/off valve (G34MV3).

v. On VENT panel, open FROM RCS FILL valve (G42MV5).

w. Open ALCOHOL TANK PRESSURE REGULATOR (G4PR1); establish 10 psig as indicated on ALCOHOL TANK gauge (G4PG2), and flush remaining alcohol into scrubber tank. Monitor fluid flow on FLOW INDICATOR (G42SG1).

x. Close on/off valve (G34MV3).

y. On VACUUM panel, open LIQUID TRAP TO RCS FILL valve (G50MV1).

z. Open collector tank drain valve (G34MV1).

aa. Open collector tank fill valve (G34MV4).

ab. Open sample port (G42MV4) and allow nitrogen to flow for 1 minute.

ac. Close sample port (G42MV4).

ad. Open flushing tank drain valve (G42MV7) and allow nitrogen to flow for 1 minute.

ae. Close drain valve (G42MV7).

af. Close ALCOHOL TANK PRESSURE REGULATOR (G4PR1).

ag. Open drain valve (G45MV1) and drain scrubber tank.

ah. Close collector tank drain valve (G34MV1).

ai. Open on/off valve (G34MV3).

aj. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV1).

ak. On VENT panel, open FROM RCS VENT valve (G42MV3).

al. Close liquid trap drain valve (G50MV4).

am. On VACUUM panel, close LIQUID TRAP TO RCS FILL valve (G50MV1).

an. On VENT panel, close FROM RCS FILL valve (G42MV5).

ao. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 10 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge scrubber tank (G45TK1) for 5 minutes.

ap. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

aq. Close all K-bottles (5).

ar. On NITROGEN PURGE panel, close TO RCS VENT valve (G4MV1).

as. On VENT panel, close FROM RCS VENT valve (G42MV3).

at. On ALCOHOL FLUSH panel, close TO RCS FILL valve (G42MV1).

au. On PRESSURE panel, verify pressure regulators (G4PR1 and G4PR2) are at full decrease.

av. Close on/off valve (G34MV3).

aw. Close collector tank fill valve (G34MV4).

ax. Close scrubber tank drain valve (G45MV1).

ay. Close scrubber tank vent valve (G45MV2).

8-8. STATUS CHARTS - VALVE POSITIONS

8-9. The following charts provide an instant checklist for determining valve positions during any portion of the cleaning procedures. These charts can be utilized as a guide when attempting to ascertain the best place to establish a hold.

S14-137

CLEANING S14-137 FUEL DEACTIVATION UNIT (EXTERNAL FLUID LINES) (SHEET 1 OF 3)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																		O	X								O
G4PR2	X														O	X							O	X				
G4MV1	X																					O			X			
G4MV2	X																											
K-Bottles	X												O															
G34MV1	X				O	X																						
G34MV2	X																											
G34MV3	X																											
G34MV4	X																											
G42MV1	X																										O	
G42MV2	X																	O			X							
G42MV3	X																											
G42MV4	X																											
G42MV5	X																											
G42MV6	X																											
G42MV7	X																											
G45MV1	X									O	X																	
G45MV2	X			O																								
G50MV1	X																											
G50MV4	X						O	X																				

O - Open
X - Closed

NOTE

All valves closed if not listed.

S14-137

CLEANING S14-137 FUEL DEACTIVATION UNIT (EXTERNAL FLUID LINES) (SHEET 2 OF 3)

		ab	ac	ad	ae	af	ag	ah	ai	aj	ak	al	am	an	ao	ap	aq	ar	as	at	au	av	aw	ax	ay	az	ba	bb
G4PR1	O	X									O	X									O	X						
G4PR2	X				O	X									O	X									O	X		
G4MV1	X																											
G4MV2	X			O			X							O			X							O			X	
K-Bottles	O																											
G34MV1	X																											
G34MV2	X																											
G34MV3	X																											
G34MV4	X																											
G42MV1	O		X							O			X							O			X					
G42MV2	X																											
G42MV3	X																											
G42MV4	X																											
G42MV5	X								O																			
G42MV6	X																		O									X
G42MV7	X																											
G45MV1	X																											
G45MV2	O																											
G50MV1	X																											
G50MV4	X																											

O - Open
X - Closed

NOTE

All valves closed if not listed.

S14-137

CLEANING S14-137 FUEL DEACTIVATION UNIT (EXTERNAL FLUID LINES) (SHEET 3 OF 3)

		bc	bd	be	bf	bg	bh	bi	bj	bk	bl	bm	bn	bo	bp	bq	br	bs	bt	bu	bv	bw	bx	by
G4PR1	X					O					X													
G4PR2	X														O					X				
G4MV1	X																							
G4MV2	X													O									X	
K-Bottles	O																							
G34MV1	X																							
G34MV2	X																							
G34MV3	X																							
G34MV4	X																							
G42MV1	X				O							X												
G42MV2	X																							
G42MV3	X																							
G42MV4	X																							
G42MV5	O																					X		
G42MV6	X			O			X		O							X		O			X			
G42MV7	X																							
G45MV1	X																							
G45MV2	O																							
G50MV1	X																							
G50MV4	X																							

O - Open
X - Closed

NOTE

All valves closed if not listed.

S14-137

CLEANING S14-137 FUEL DEACTIVATION UNIT (INTERNAL COMPONENTS) (SHEET 1 OF 2)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X				O		X									O	X							O				
G4PR2	X									O	X																	
G4MV1	X								O			X																
G4MV2	X																											
K-Bottles	O																											
G34MV1	X																										O	
G34MV2	X					O															X							
G34MV3	X																					O			X			
G34MV4	X	O																		X								O
G42MV1	X														O													
G42MV2	X			O				X																				
G42MV3	X		O										X															
G42MV4	X																											
G42MV5	X																						O					
G42MV6	X																											
G42MV7	X																											
G45MV1	X																											
G45MV2	O																											
G50MV1	X													O				X								O		
G50MV4	X																		O									

O - Open
X - Closed

NOTE

All valves closed if not listed.

S14-137

CLEANING S14-137 FUEL DEACTIVATION UNIT
(INTERNAL COMPONENTS) (SHEET 2 OF 2)

		ab	ac	ad	ae	af	ag	ah	ai	aj	ak	al	am	an	ao	ap	aq	ar	as	at	au	av	aw	ax	ay			
G4PR1	O					X																						
G4PR2	X														O	X												
G4MV1	X									O								X										
G4MV2	X																											
K-Bottles	O																X											
G34MV1	O							X																				
G34MV2	X																											
G34MV3	X								O													X						
G34MV4	O																						X					
G42MV1	O																			X								
G42MV2	X																											
G42MV3	X										O								X									
G42MV4	X	O	X																									
G42MV5	O													X														
G42MV6	X																											
G42MV7	X			O	X																							
G45MV1	X						O																	X				
G45MV2	O																								X			
G50MV1	O												X															
G50MV4	O											X																

O - Open
X - Closed

NOTE

All valves closed if not listed.

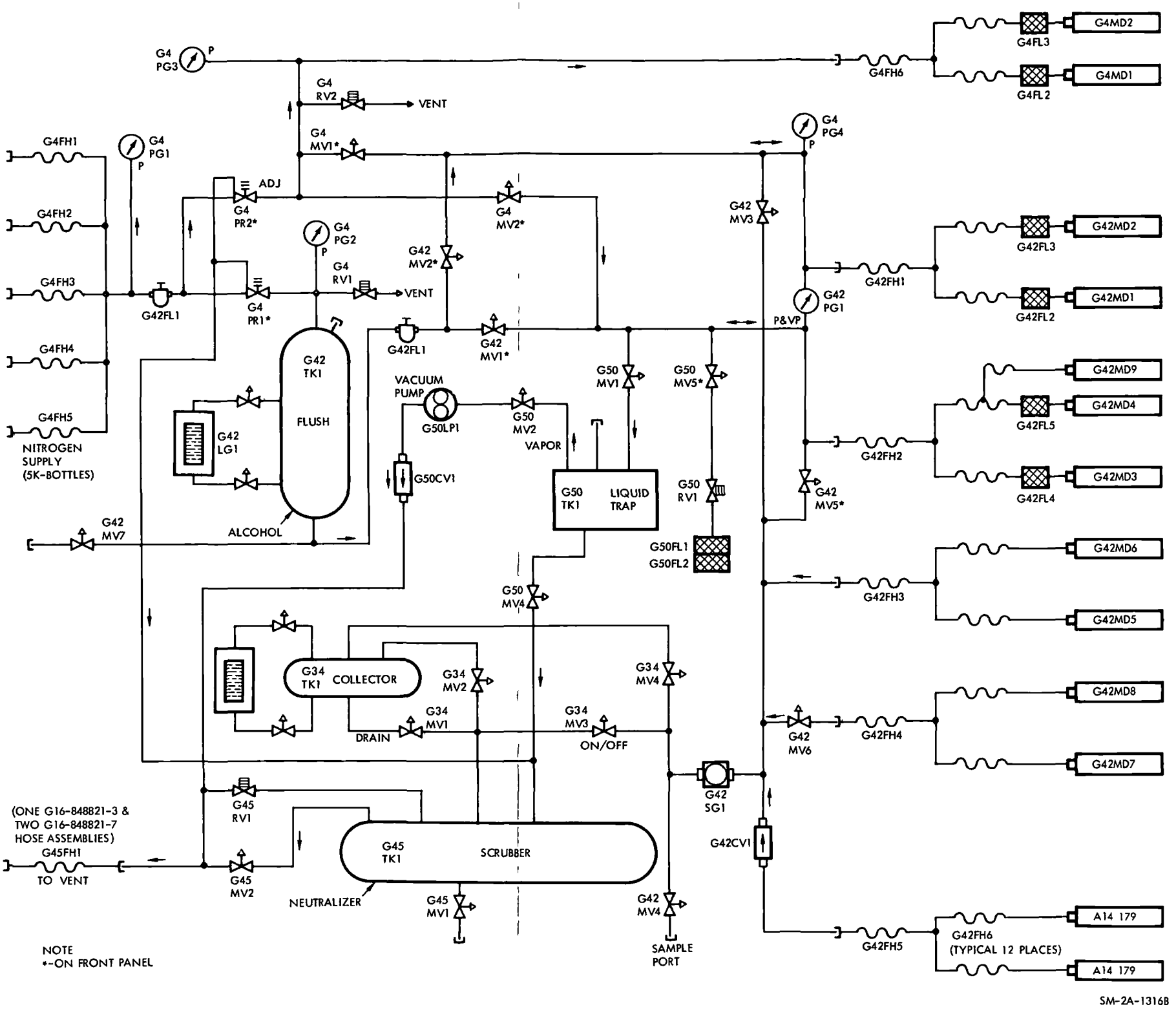


Figure 8-1 Cleaning S14-137 Fuel Deactivation Unit

8-10. S14-138.

8-11. Cleaning procedures are divided into two parts. Part one (steps a through by) covers the external fluid lines and fittings; part two (paragraph 8-12) covers the internal components of the unit. To prepare the S14-138 deactivation unit external fluid lines for return shipment, accomplish the following cleaning procedures:

a. Verify all valves and regulators are in the closed or off position, and the hookup configuration conforms with figure 8-2.

b. Position unit as necessary to facilitate draining of all liquids.

c. Open (G45MV2) vent valve to scrubber tank (G45TK1).

d. Open (G32MV1) drain valve to collector tank (G32TK1) and drain contents into scrubber tank.

NOTE

To expedite the draining process, the tank may be vented by opening the valve between the tank and the level gauge upper valve, or by opening collector tank fill valve (G32MV2); sampling valve (G42MV4) and removing cap from sampling fitting.

e. Close collector tank drain valve (G32MV1) and any valves opened for venting.

f. Open (G50MV4) drain valve to liquid trap (G50TK1) and drain contents into scrubber tank.

NOTE

To expedite the draining process, venting may be accomplished by loosening the plug on top of the tank.

g. Close liquid trap drain valve (G50MV4) and tighten cap on top of tank, if loosened.

h. Connect a length of tubing from suitable container to scrubber tank drain port.

i. Open drain valve (G45MV1) and drain contents of scrubber tank.

j. Close scrubber tank drain valve (G45MV1).

k. Service flushing tank (G42TK1) with freon. (Refer to paragraph 2-34.)

l. Open all K-bottle valves (5).

m. On PRESSURE panel, verify 1500 psig on NITROGEN SUPPLY gauge (G4PG1). (Remove and replace expended K-bottles as necessary.)

n. On PRESSURE panel, slowly open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95625 flex hose (G4FH6) for 1 minute.

o. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

p. On interface panel, disconnect flex hose (G4FH6) from RCS OXID CHECK VALVES—HELIUM PANEL port and cap ends.

q. On FREON FLUSH panel, open TO RCS VENT valve (G42MV2).

r. Open FREON TANK PRESSURE REGULATOR (G4PR1) and establish flow of freon through 95579 flex hose (G42FH1) for 1 minute.

s. Close FREON TANK PRESSURE REGULATOR (G4PR1).

t. On FREON FLUSH panel, close TO RCS VENT valve (G42MV2).

u. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV1).

v. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95579 flex hose (G42FH1) for 1 minute.

w. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

x. On NITROGEN PURGE panel, close TO RCS VENT vlave (G4MV1).

y. On interface panel, disconnect flex hose (G42FH1) from RCS OXID VENT port and cap ends.

z. On FREON FLUSH panel, open TO RCS FILL valve (G42MV1).

aa. Open FREON TANK PRESSURE REGULATOR (G4PR1) and establish a flow of freon through 95881 flex hose (G42FH2) for 1 minute.

ab. Close FREON TANK PRESSURE REGULATOR (G4PR1).

ac. On FREON FLUSH panel, close TO RCS FILL valve (G42MV1).

ad. On NITROGEN PURGE panel, open TO RCS FILL valve (G42MV2).

ae. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95581 flex hose (G42FH2) for 1 minute.

af. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

ag. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

ah. On interface panel, disconnect flex hose (G42FH2) from OXID LIQUID SIDE VENTS port and cap ends.

ai. On VENT panel, open FROM RCS FILL valve (G42MV5).

aj. On FREON FLUSH panel, open TO RCS FILL valve (G42MV1).

ak. Open FREON TANK PRESSURE REGULATOR (G4PR1) and establish a flow of freon through flex hose (G42FH3) for 1 minute.

al. Close FREON TANK PRESSURE REGULATOR (G4PR1).

am. On FREON FLUSH panel, close TO RCS FILL valve (G42MV1).

an. On NITROGEN PURGE panel, open TO RCS FILL valve (G4MV2).

ao. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge G16-848826-5 flex hose (G42FH3) for 1 minute.

ap. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

aq. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

ar. On interface panel, disconnect flex hose (G42FH3) from TEST POINTS OXID PANEL port and cap ends.

as. On VENT panel, open FROM RCS LIQUID SIDE VENT valve (G42MV6).

at. On FREON FLUSH panel, open TO RCS VENT valve (G42MV1).

au. Open FREON TANK PRESSURE REGULATOR (G4PR1) and establish a flow of freon through flex hose (G42FH4) for 1 minute.

NOTE

If G16-848613 hoses (G42FH8 and G42FH9) and two M666000-12-0240 hose assemblies were used for decontamination, connect these assemblies to G42FH4 flex hose and open shutoff valves in the two M666000-12-0240 hose assemblies.

av. Close FREON TANK PRESSURE REGULATOR (G4PR1).

aw. On FREON FLUSH panel, close TO RCS VENT valve (G42MV1).

ax. On NITROGEN PURGE panel, open TO RCS FILL valve (G42MV2).

ay. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge 95581 flex hose (G42FH4) for 1 minute.

az. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

ba. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

bb. On VENT panel, close FROM RCS LIQUID SIDE VENT valve (G42MV6).

bc. On interface panel, disconnect flex hose (G42FH4) from RCS OXID FILL port and cap ends.

NOTE

If overboard dump hoses (G42FH8, G42FH9 and two M666000-12-0240) are connected to G42FH4 flex hose, disconnect all hoses from G42FH4 and cap hoses.

bd. Disconnect G16-848824-5 hose assembly (G42FH5) from interface panel at RCS ENGINES port and reconnect it to RCS OXID FILL port on interface panel.

NOTE

Prior to proceeding further, cap all hose/ A14-179 interface connectors; except the pair nearest the deactivation unit.

be. On VENT panel, open FROM RCS LIQUID SIDE VENT valve (G42MV6).

bf. On FREON FLUSH panel, open TO RCS VENT valve (G42MV1).

bg. Open FREON TANK PRESSURE REGULATOR (G4PR1) and establish a flow of freon through the nearest pair of G16-848825-5 engine hose assemblies (G42FH6) for 1 minute.

bh. On VENT panel, close FROM RCS LIQUID SIDE VENT valve (G42MV6).

bi. Remove caps from next (downstream) pair of connectors and reinstall on next nearest pair.

bj. Open FROM RCS LIQUID SIDE VENT valve (G42MV6) and establish a flow of freon for 1 minute.

bk. Repeat steps bh through bj until all lines are flushed with freon.

bl. Close FREON TANK PRESSURE REGULATOR (G4PR1).

bm. On FREON FLUSH panel, close TO RCS VENT valve (G42MV1).

bn. Remove caps from the nearest pair of engine hose assemblies and reinstall on last pair of lines flushed in steps bg through bk.

bo. On NITROGEN PURGE panel, open TO RCS FILL valve (G4MV2).

bp. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge the nearest pair of G16-848825-5 engine hose assemblies (G42FH6) for 1 minute.

bq. On VENT panel, close FROM RCS LIQUID SIDE VENT valve (G42MV6).

br. Remove caps from next (downstream) pair of connectors and reinstall on next nearest pair.

bs. Open FROM RCS LIQUID SIDE VENT valve (G42MV6) and purge for 1 minute.

bt. Repeat steps bq through bs until all lines are purged with nitrogen.

bu. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

bv. Close FROM RCS LIQUID SIDE VENT valve (G42MV6).

bw. Close FROM RCS FILL valve (G42MV5).

bx. On NITROGEN PURGE panel, close TO RCS FILL valve (G4MV2).

by. Disconnect G16-848824-5 hose assembly (G42FH5) from interface panel at RCS OXID FILL port and cap all connectors.

8-12. Complete S14-138 cleaning procedures by accomplishing the following steps:

a. Open fill valve (G32MV4) at collector tank (G32TK1).

b. On VENT panel, open FROM RCS VENT valve (G42MV3).

c. On FREON FLUSH panel, open TO RCS VENT valve (G42MV2).

d. Open FREON TANK PRESSURE REGULATOR (G4PR1); establish freon flow into collector tank, and fill collector tank with freon while monitoring fluid level on sight glass.

e. Open collector tank vent valve (G32MV2).

f. Close FREON TANK PRESSURE REGULATOR (G4PR1).

g. On FREON FLUSH panel, close TO RCS VENT valve (G42MV2).

h. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV1).

i. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2) and establish 5±2 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3).

j. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

k. Close TO RCS VENT valve (G4MV1).

l. On VENT panel, close FROM RCS VENT valve (G42MV3).

m. On VACUUM panel, open LIQUID TRAP TO RCS FILL valve (G50MV1).

n. On FREON FLUSH panel, open TO RCS FILL valve (G42MV1).

o. Open FREON TANK PRESSURE REGULATOR (G4PR1); adjust G4PR1 to 10 psig as indicated on FREON TANK gauge (G4PG2), and establish flow of freon into liquid trap (G50TK1) for 1 minute minimum.

p. Close FREON TANK PRESSURE REGULATOR (G4PR1).

q. Close LIQUID TRAP TO RCS FILL valve (G50MV1).

r. Open drain valve (G50MV4) and allow liquid trap to drain.

s. Close collector tank fill valve (G32MV4).

t. Close collector tank vent valve (G32MV2).

u. Open on/off valve (G32MV3).

v. On VENT panel, open FROM RCS FILL valve (G42MV5).

w. Open FREON TANK PRESSURE REGULATOR (G4PR1); establish 10 psig as indicated on FREON TANK gauge (G4PG2), and flush remaining freon into scrubber tank. Monitor fluid flow on FLOW INDICATOR (G42SG1).

x. Close on/off valve (G32MV3).

y. On VACUUM panel, open LIQUID TRAP TO RCS FILL valve (G50MV1).

z. Open collector tank drain valve (G32MV1).

aa. Open collector tank fill valve (G32MV4).

ab. Open sample port (G42MV4) and allow nitrogen to flow for 1 minute.

ac. Close sample port (G42MV4).

ad. Open flushing tank drain valve (G42MV7) and allow nitrogen to flow for 1 minute.

ae. Close drain valve (G42MV7).

af. Close FREON TANK PRESSURE REGULATOR (G4PR1).

ag. Open drain valve (G45MV1) and drain scrubber tank.

ah. Close drain valve (G32MV1).

ai. Open on/off valve (G32MV3).

aj. On NITROGEN PURGE panel, open TO RCS VENT valve (G4MV1).

ak. On VENT panel, open FROM RCS VENT valve (G42MV3).

al. Close liquid trap drain valve (G50MV4).

am. On VACUUM panel, close LIQUID TRAP TO RCS FILL valve (G50MV1).

an. On VENT panel, close FROM RCS FILL valve (G42MV5).

ao. Open NITROGEN PURGE PRESSURE REGULATOR (G4PR2); establish 10 psig as indicated on RCS HELIUM CHECK VALVE gauge (G4PG3), and purge scrubber tank (G45TK1) for 5 minutes.

ap. Close NITROGEN PURGE PRESSURE REGULATOR (G4PR2).

aq. Close all K-bottles (5).

ar. On NITROGEN PURGE panel, close TO RCS VENT valve (G4MV1).

as. On VENT panel, close FROM RCS VENT valve (G42MV3).

at. On FREON FLUSH panel, close TO RCS FILL valve (G42MV1).

aw. On PRESSURE panel, verify pressure regulator (G4PR1 and G4PR2) are at full decrease.

av. Close on/off valve (G32MV3).

aw. Close collector tank fill valve (G32MV4).

ax. Close scrubber tank drain valve (G45MV1).

ay. Close scrubber tank vent valve (G45MV2).

8-13. STATUS CHARTS - VALVE POSITIONS

8-14. The following charts provide an instant checklist for determining valve positions during any portion of the cleaning procedures. These charts can be utilized as a guide when attempting to ascertain the best place to establish a hold.

S14-138

CLEANING S14-138 OXIDIZER DEACTIVATION UNIT (EXTERNAL FLUID LINES) (SHEET 1 OF 3)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X																		O	X								O
G4PR2	X														O	X							O	X				
G4MV1	X																					O			X			
G4MV2	X																											
K-Bottles	X												O															
G32MV1	X				O	X																						
G32MV2	X																											
G32MV3	X																											
G32MV4	X																											
G42MV1	X																										O	
G42MV2	X																	O			X							
G42MV3	X																											
G42MV4	X																											
G42MV5	X																											
G42MV6	X																											
G42MV7	X																											
Ovbd Dump	X																											
G45MV1	X									O	X																	
G45MV2	X			O																								
G50MV1	X																											
G50MV4	X						O	X																				

O - Open
X - Closed

NOTE

All valves closed if not listed.

CLEANING S14-138 OXIDIZER DEACTIVATION UNIT
(EXTERNAL FLUID LINES) (SHEET 2 OF 3)

		ab	ac	ad	ae	af	ag	ah	ai	aj	ak	al	am	an	ao	ap	aq	ar	as	at	au	av	aw	ax	ay	az	ba	bb
G4PR1	O	X									O	X									O	X						
G4PR2	X				O	X									O	X									O	X		
G4MV1	X																											
G4MV2	X			O			X							O			X							O			X	
K-Bottles	O																											
G32MV1	X																											
G32MV2	X																											
G32MV3	X																											
G32MV4	X																											
G42MV1	O		X							O			X							O			X					
G42MV2	X																											
G42MV3	X																											
G42MV4	X																											
G42MV5	X								O																			
G42MV6	X																		O									X
G42MV7	X																											
Ovbd Dump	X																				O							
G45MV1	X																											
G45MV2	O																											
G50MV1	X																											
G50MV4	X																											

O - Open
X - Closed

NOTE

All valves closed if not listed.

CLEANING S14-138 OXIDIZER DEACTIVATION UNIT (EXTERNAL FLUID LINES) (SHEET 3 OF 3)

		bc	bd	be	bf	bg	bh	bi	bj	bk	bl	bm	bn	bo	bp	bq	br	bs	bt	bu	bv	bw	bx	by
G4PR1	X					O					X													
G4PR2	X														O					X				
G4MV1	X																							
G4MV2	X													O									X	
K-Bottles	O																							
G32MV1	X																							
G32MV2	X																							
G32MV3	X																							
G32MV4	X																							
G42MV1	X				O							X												
G42MV2	X																							
G42MV3	X																							
G42MV4	X																							
G42MV5	O																					X		
G42MV6	X			O			X		O							X		O			X			
G42MV7	X																							
Ovbd Dump	O																							
G45MV1	X																							
G45MV2	O																							
G50MV1	X																							
G50MV4	X																							

O - Open
X - Closed

NOTE

All valves closed if not listed.

S14-138

CLEANING S14-138 OXIDIZER DEACTIVATION UNIT
(INTERNAL COMPONENTS) (SHEET 1 OF 2)

		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa
G4PR1	X				O		X									O	X							O				
G4PR2	X									O	X																	
G4MV1	X								O			X																
G4MV2	X																											
K-Bottles	O																											
G32MV1	X																										O	
G32MV2	X					O															X							
G32MV3	X																					O			X			
G32MV4	X	O																		X								O
G42MV1	X														O													
G42MV2	X			O				X																				
G42MV3	X		O										X															
G42MV4	X																											
G42MV5	X																						O					
G42MV6	X																											
G42MV7	X																											
G45MV1	X																											
G45MV2	O																											
G50MV1	X													O				X								O		
G50MV4	X																		O									

O - Open
X - Closed

NOTE

All valves closed if not listed.

S14-138

CLEANING S14-138 OXIDIZER DEACTIVATION UNIT (INTERNAL COMPONENTS) (SHEET 2 OF 2)

		a b	a c	a d	a e	a f	a g	a h	a i	a j	a k	a l	a m	a n	a o	a p	a q	a r	a s	a t	a u	a v	a w	a x	a y
G4PR1	O					X																			
G4PR2	X														O	X									
G4MV1	X									O								X							
G4MV2	X																								
K-Bottles	O																X								
G32MV1	O							X																	
G32MV2	X																								
G32MV3	X								O													X			
G32MV4	O																						X		
G42MV1	O																			X					
G42MV2	X																								
G42MV3	X										O								X						
G42MV4	X	O	X																						
G42MV5	O													X											
G42MV6	X																								
G42MV7	X			O	X																				
G45MV1	X						O																	X	
G45MV2	O																								X
G50MV1	O												X												
G50MV4	O											X													

O - Open
X - Closed

NOTE

All valves closed if not listed.

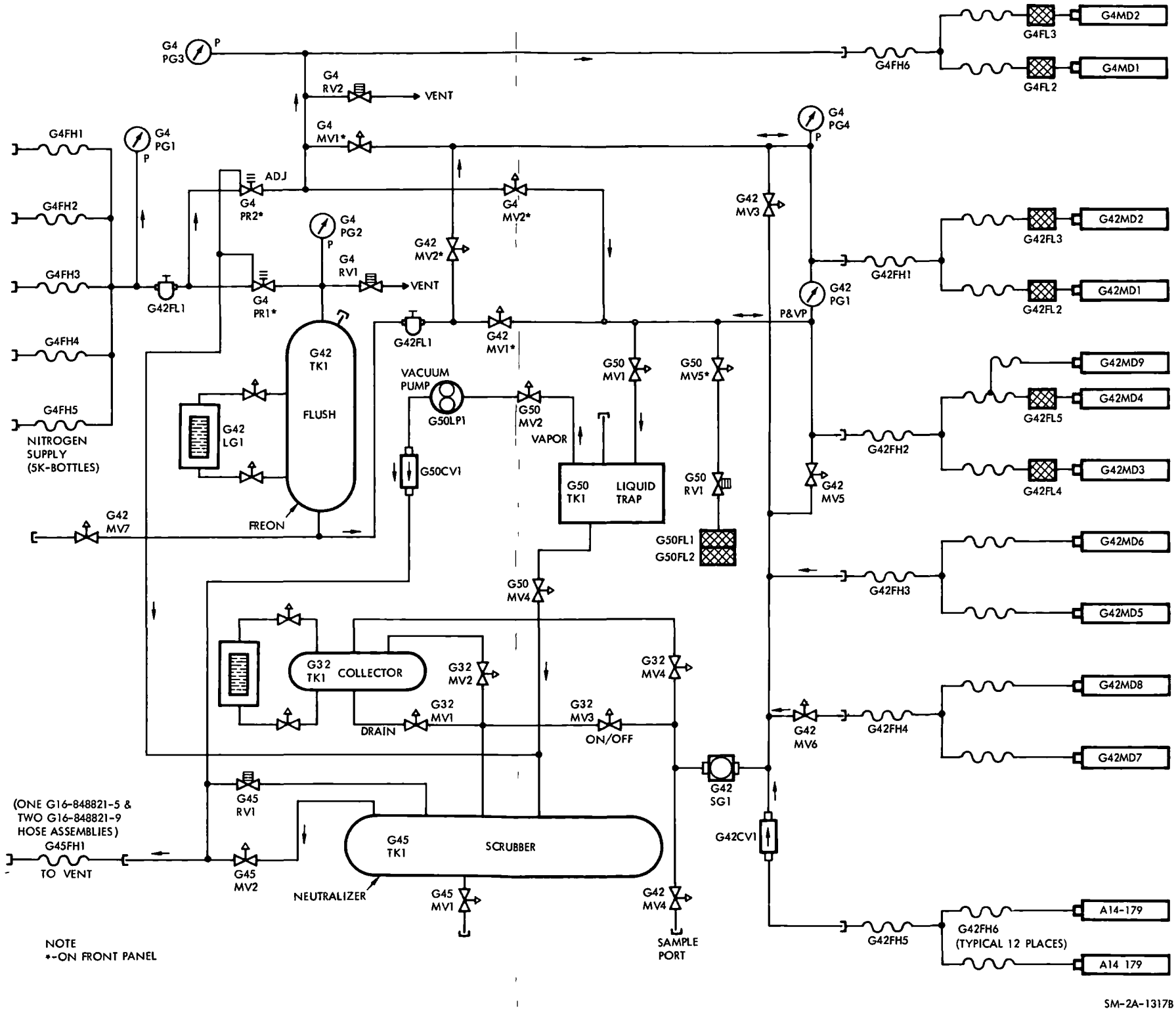


Figure 8-2 Cleaning S14-138 Oxidizer Deactivation Unit

SECTION IX

ELECTRICAL INTERFACE DIAGRAMS

9-1. INTRODUCTION

9-2. This section contains integrated electrical diagrams showing pin-to-pin connections of the RCS engines, and isolation valves related to RCS decontamination. (See figures 9-1 through 9-12.) Diagrams are provided to facilitate trouble analysis should a malfunction or an open circuit occur. In addition, the diagrams eliminate the need for transporting wire lists as well as providing a condensed version of engineering drawings, schematics, etc., related to the deactivation units and CM.

NOTE

Drawings utilized to prepare the illustrations within this section (together with applicable EOs) are provided. Accordingly, should any question arise regarding "latest information," it is suggested that the referenced drawings be checked for later changes.

V16-440017 NC EO M495048		Electrical System Installation - Complete
V16-447171 D EO M615607		Electrical Installation - Aft Compartment
V16-420635 D EO M576519	(C05W3)	Harness Assembly - Aft Compartment
V16-420662 NC EO M566603	(C05W7)	Harness Assembly - Aft Compartment
V16-942111 B EO M603554	(C19B1 - B12)	Wiring Diagram - Pigtail Terminations Installation
V16-447596 B	(C19A1 & C19A2)	Box Assembly - Electrical Controller Reaction Control System

V16-420311 A	(C19A1 & C19A2)	Harness Assembly - Reaction Control System, Control Box W1
V16-446122 A EO M568762 EO M378080		Electrical Systems Installation - Forward Compartment (Perspective)
V16-420614 B EO M549024 EO M520741	(C04W3)	Harness Assembly - Forward Compartment
V16-420615 B EO M549025 EO M520717	(C04W4)	Harness Assembly - Forward Compartment
V16-441171 A EO M603850 EO M603835 EO M603845 EO M495091 EO M495079 EO M495048 EO M491503 EO M491505 EO M491504		Electrical Equipment Installation - Central Crew Compartment
V16-420601 C EO M619477	(C03W1)	Harness Assembly - Crew Compartment
V16-420602 F EO M467268 EO M573949	(C03W2)	Harness Assembly - Crew Compartment
G16-848760 B EO M567166 EO M567485 EO M530347 EO T32337 EO M553198 EO T36812	(S14-137)	RCS Fuel Deactivation Unit Assembly
G16-984876 A	(S14-137)	System Schematic Diagram - Electrical RCS Deactivation Unit, Fuel

G16-984878 A	(S14-137)	Interconnecting Diagram - Electrical, RCS Fuel Decontamination Unit
N16-840015 NC EO M634315	(S14-137)	Plaque - Fluid Schematic, RCS Fuel Deactivation Unit
G16-848770 B EO M567166 EO M567485 EO M530347 EO M492303 EO M467338 EO T36812 EO T32255 EO T36629	(S14-138)	RCS Oxidizer Deactivation Unit Assembly
G16-984873 A	(S14-138)	System Schematic Diagram - Electrical, RCS Deactivation Unit, Oxidizer
G16-984877 NC	(S14-138)	Interconnecting Diagram - Electrical, RCS Oxidizer Decontamination Unit
N16-840016 NC EO M634315	(S14-138)	Plaque - Fluid Schematic, RCS Oxidizer Deactivation Unit
G16-848742 NC EO M562236 EO M467316 EO M428117 EO T35322 EO T35280		Loose Equipment - RCS Propellant Deactivation Unit
G16-848782 A EO T31404 EO T21537 EO T30589	(A1)	Panel Assy - Control, Fuel & Oxidizer, RCS Decontamination Unit (A1)
G16-848783 B	(A1)	Wire Bundle - Control Panel
G16-984871 A	(A1)	Circuit Schematic, Diagram - Electrical, Control Panel

G16-848784 A EO T31404 EO T30589	(A2)	Control Chassis Assembly - RCS Deactivation Unit
G16-848785 A	(A2)	Wire Bundle - Control Chassis
G16-984872 A	(A2)	Circuit Schematic Diagram - Electrical, Control Chassis
G16-848582 B EO M567474 EO M563757 EO M553199 EO M467327 EO M476782	(A3)	Panel Assy - Interface, RCS Propellant Deactivation Unit
G16-848831 A EO M530593 EO M530701 EO M530347 EO M530348	(A3 - S14-137)	Wire Bundle - Interface Panel
G16-848787 A EO M530593 EO M530701 EO M530347 EO M530348	(A3 - S14-138)	Wire Bundle - Interface Panel
G16-848788 A	(A3 - A2)	Wire Bundle - Interconnection Wire
G16-848798 A	(W1 & W2)	Power Cable
G16-848797 A	(W3 - S14-138)	Harness Assy - Isolation Valve Control, Oxidizer
G16-848786 A	(W4 - S14-137)	Harness Assy - Engine Valve Control, System "A", Fuel
G16-848789 A	(W4 - S14-138)	Harness Assy - Engine Valve Control, System "A", Oxidizer

G16-824499 NC EO M606679	(A14-179)	Adapter Set Assy - Reaction Control System, End Item
G16-824521 B EO M567433 EO M281649	(A14-179)	Adapter - Reaction Control System, Assy of
8N16-880016 NC EO M530629 EO M563771		Mod Kit

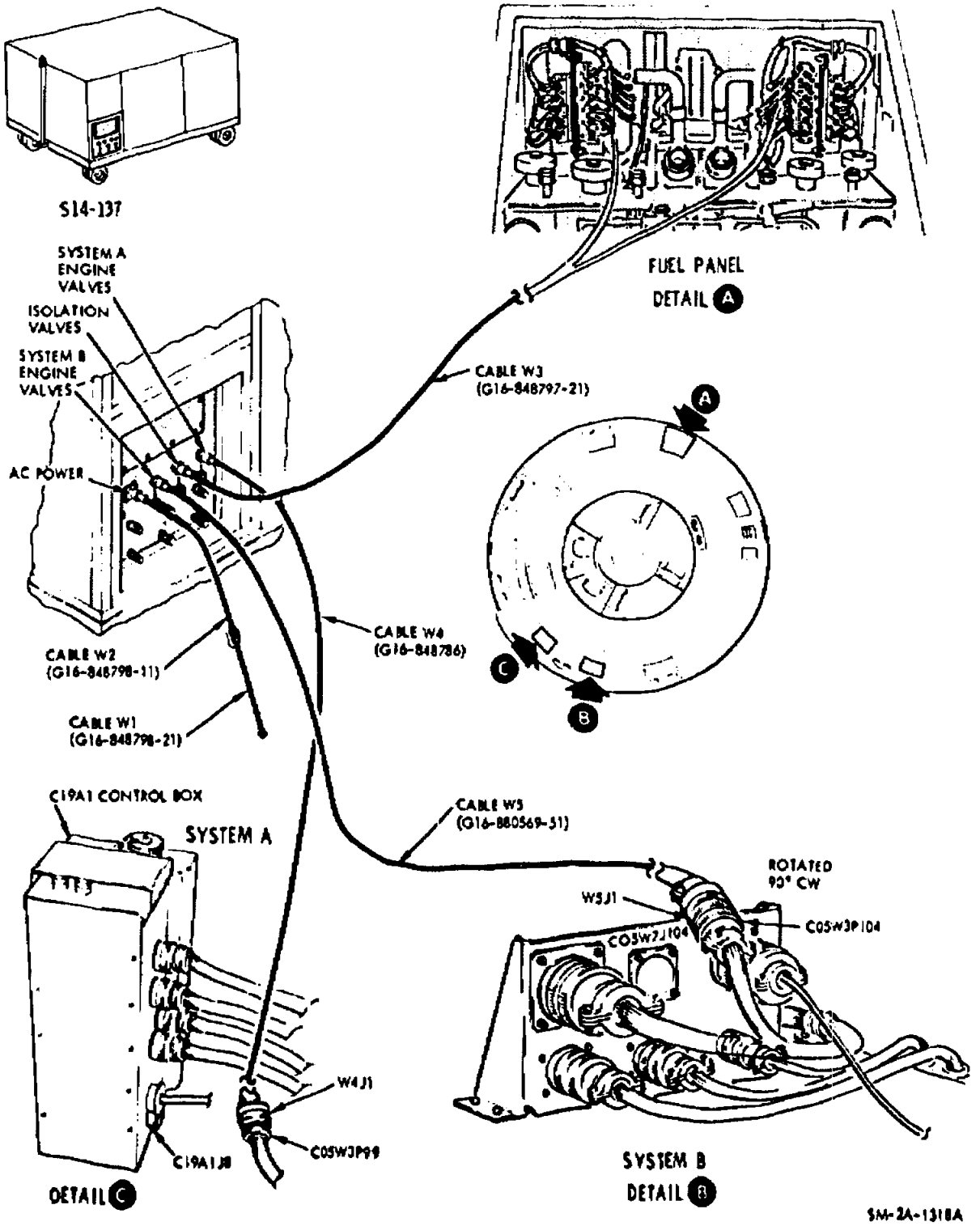


Figure 9-1. S14-137—CM Electrical Interface (Sheet 1 of 2)

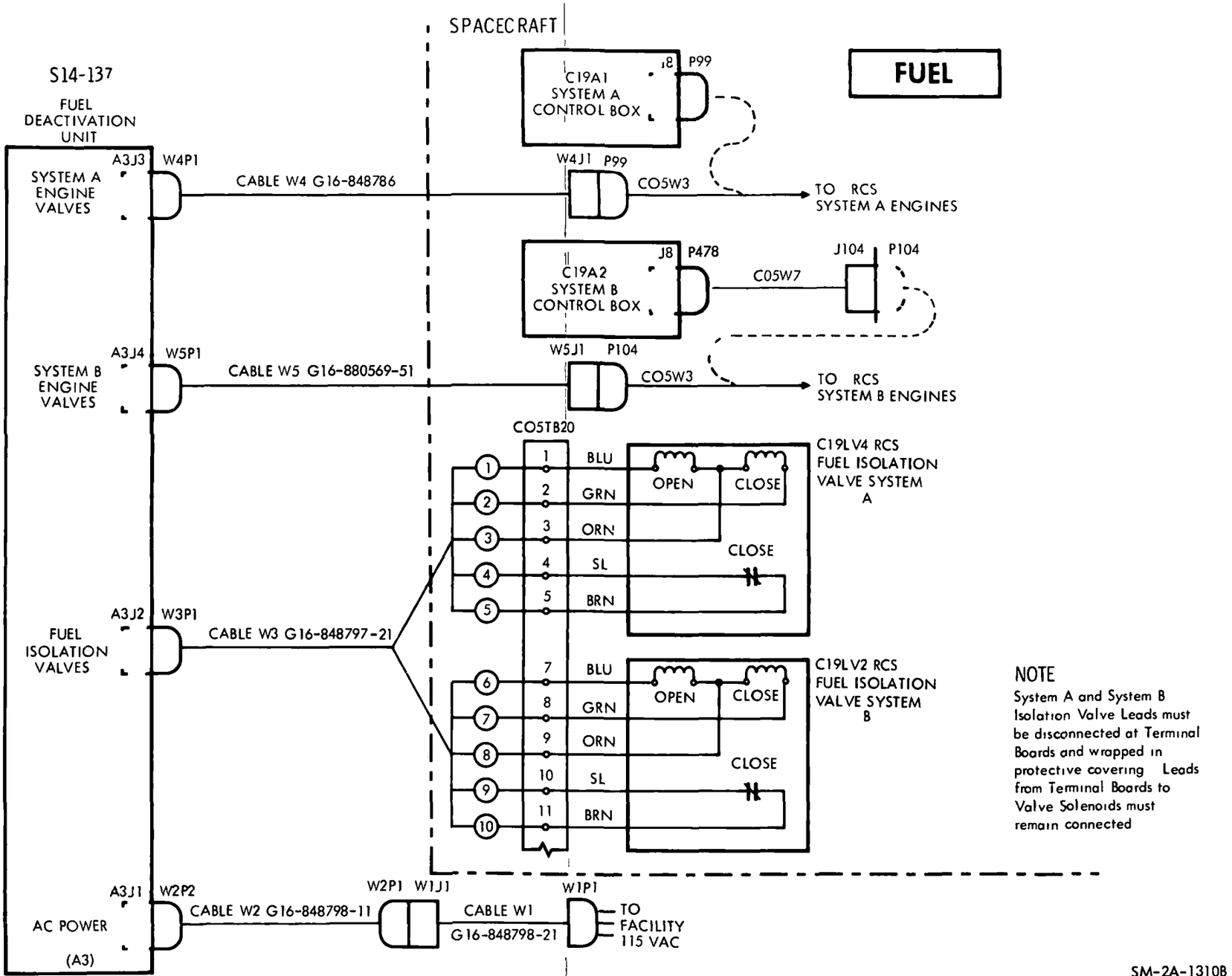
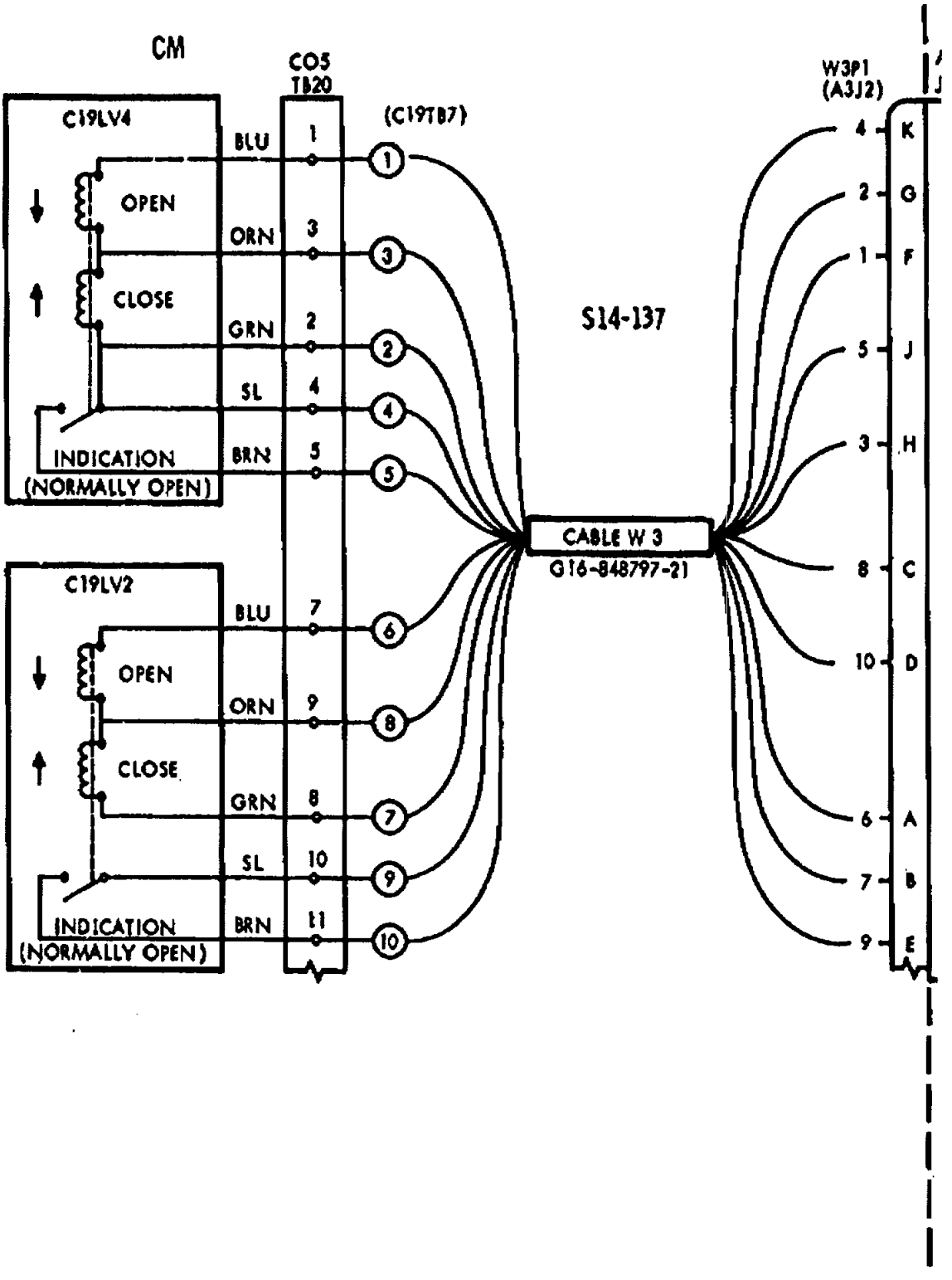


Figure 9-1 S14-137—CM Electrical Interface (Sheet 2 of 2)


CM
CO5
TB20
W3P1
(A3J2)
C19LV4
OPEN
CLOSE
INDICATION
(NORMALLY OPEN)
BLU
ORN
GRN
SL
BRN
1
3
2
4
5
(C19TB7)
S14-137
CABLE W 3
G16-848797-21
4
2
1
5
3
8
10
6
7
9
K
G
F
J
H
C
D
A
B
E
C19LV2
OPEN
CLOSE
INDICATION
(NORMALLY OPEN)
BLU
ORN
GRN
SL
BRN
7
9
8
10
11

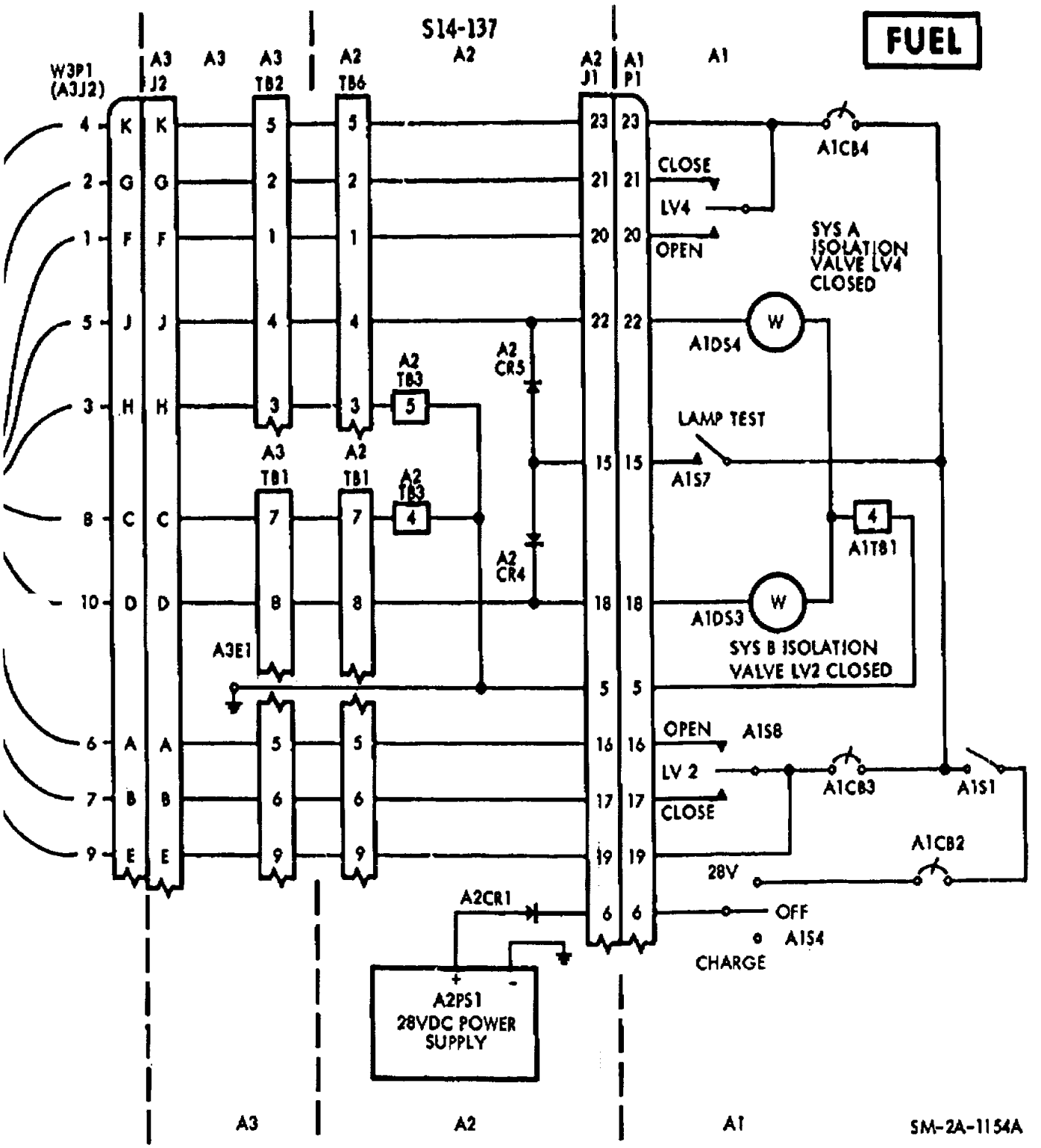


Figure 9-2. S14-137—CM Fuel Isolation Valves—Detailed Interface Schematic

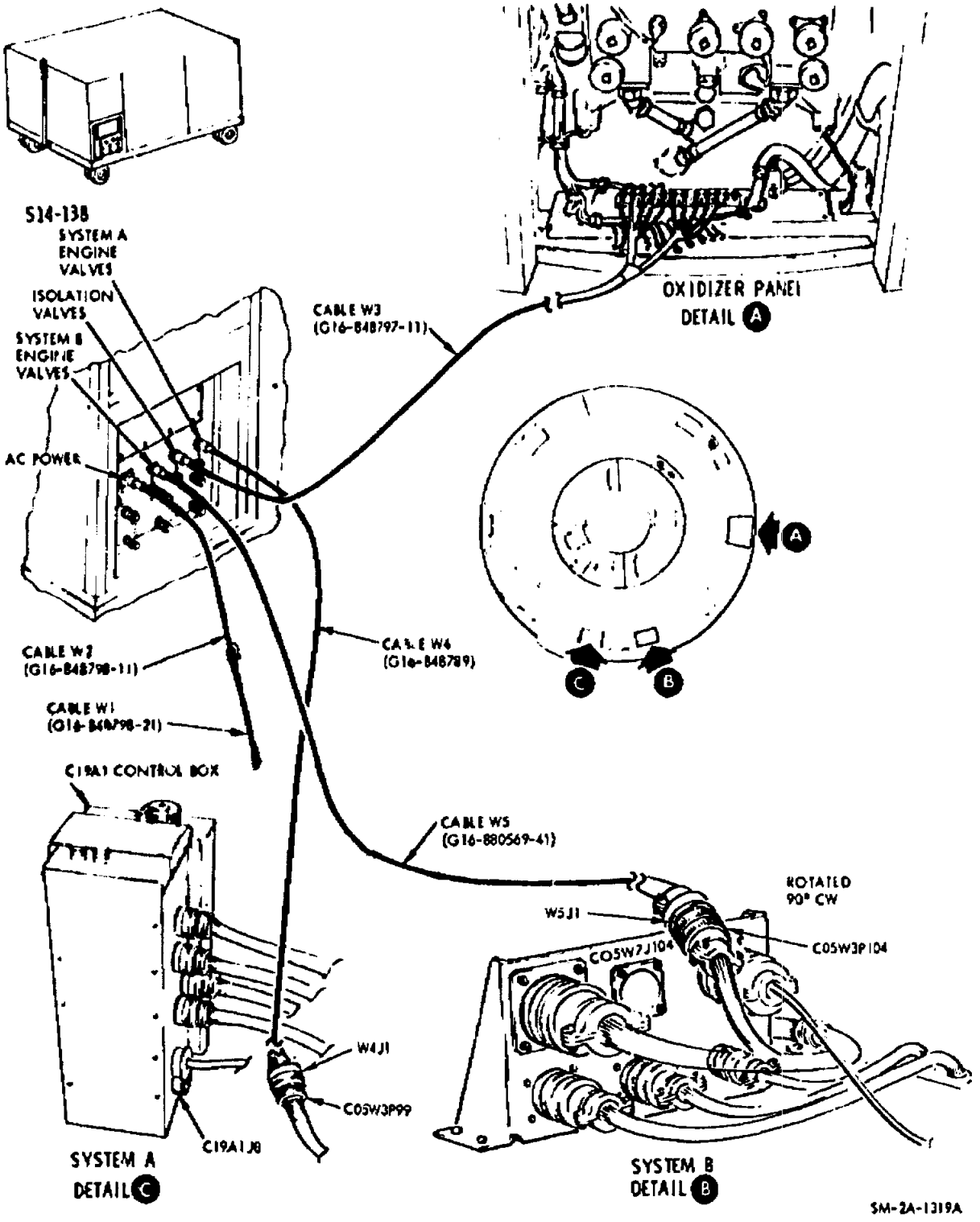


Figure 9-3. S14-138—CM Electrical Interface (Sheet 1 of 2)

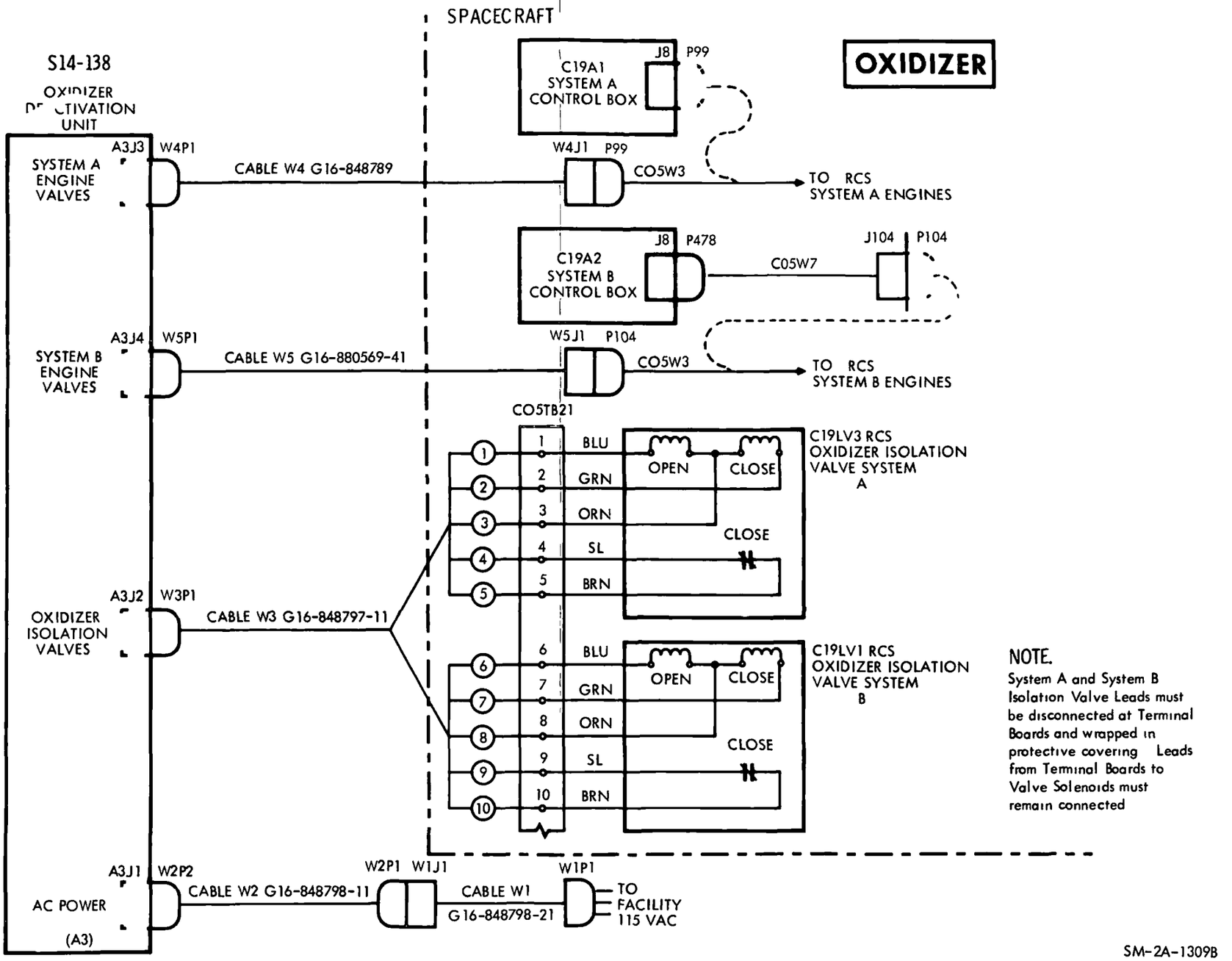
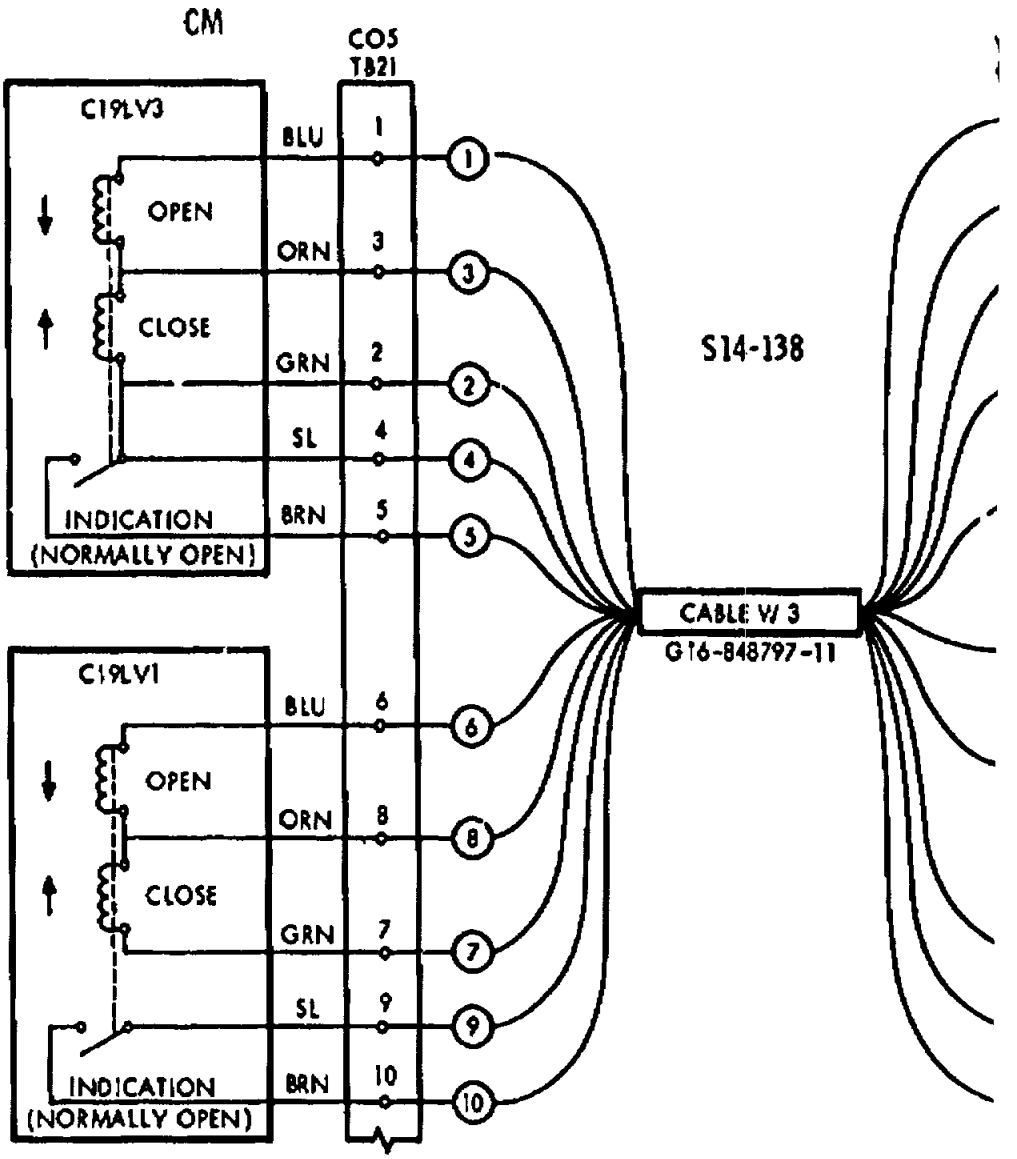


Figure 9-3 S14-138—CM Electrical Interface (Sheet 2 of 2)


CM
CO5
TB21
C19LV3
BLU
1
OPEN
ORN
3
CLOSE
GRN
2
SL
4
INDICATION
(NORMALLY OPEN)
BRN
5
C19LV1
BLU
6
OPEN
ORN
8
CLOSE
GRN
7
SL
9
INDICATION
(NORMALLY OPEN)
BRN
10
1
3
2
4
5
6
8
7
9
10
CABLE W 3
G16-848797-11
S14-138

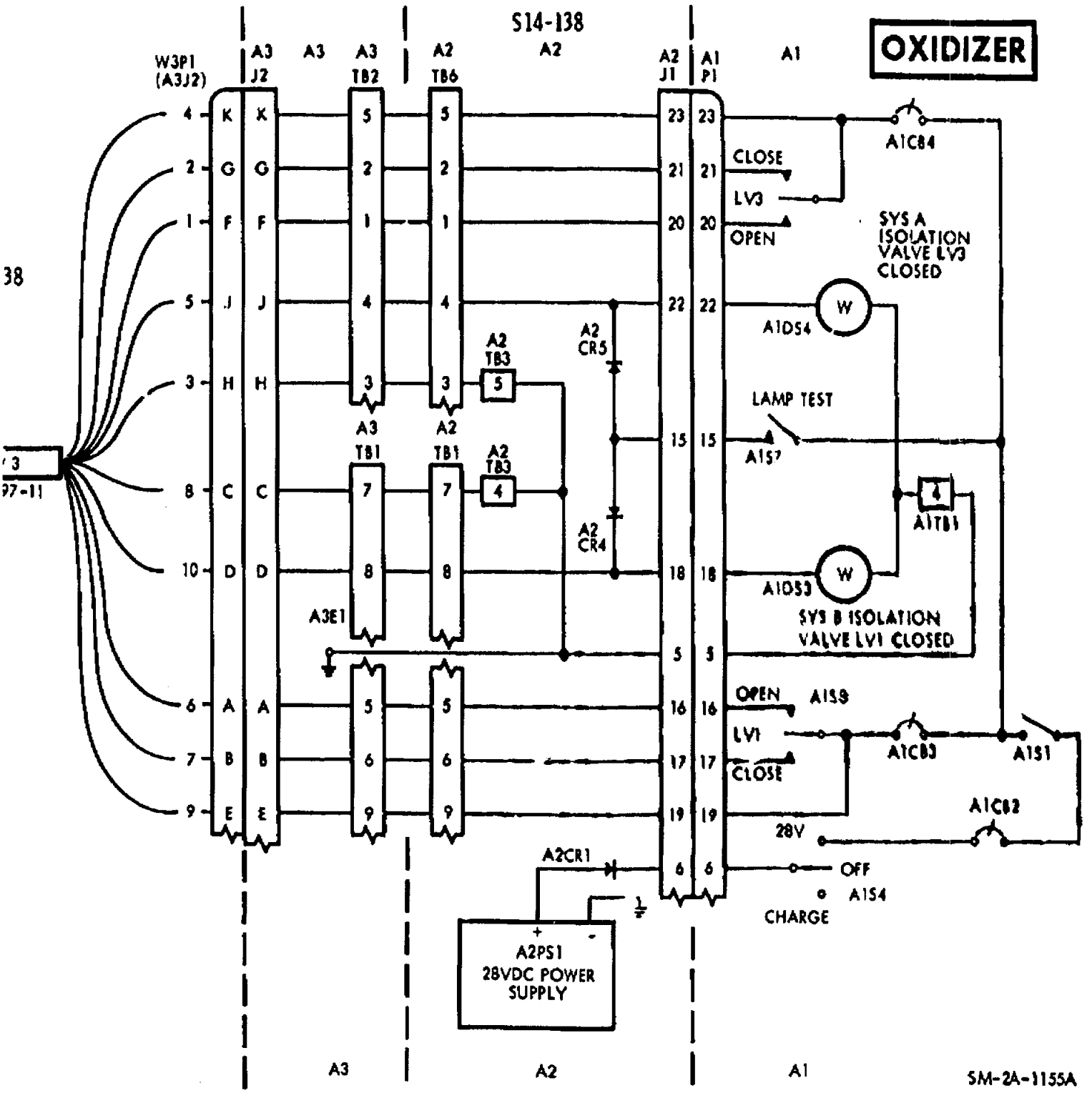
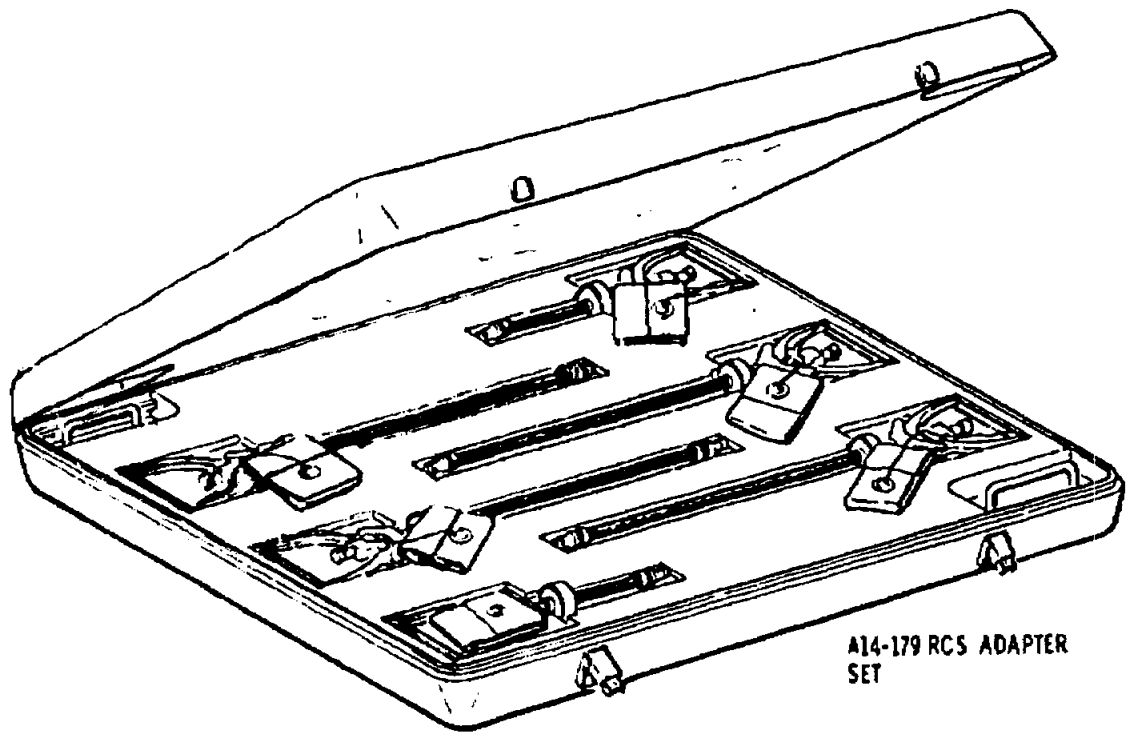
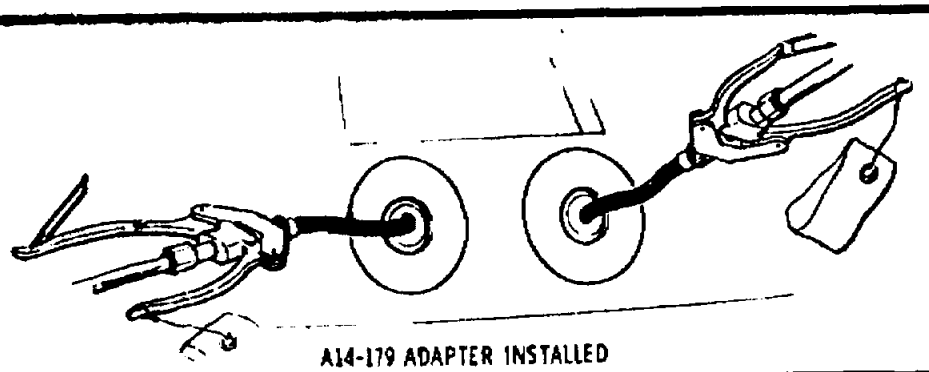


Figure 9-4. S14-138—CM Oxidizer Isolation Valves—Detailed Interface Schematic





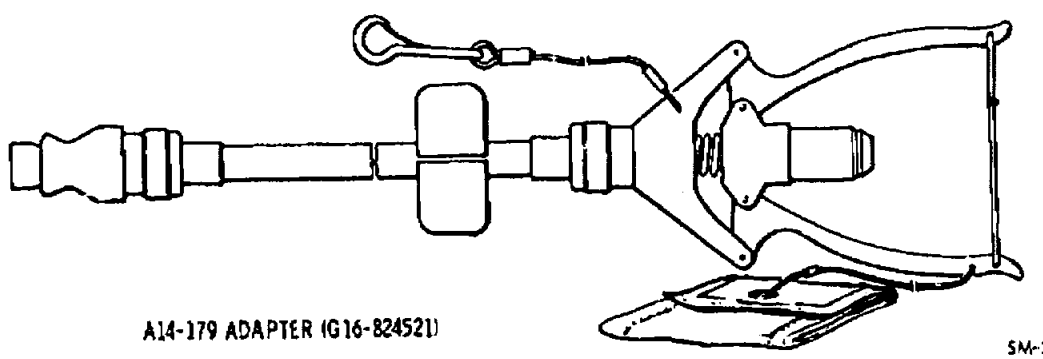


Figure 9-5. A14-179 Adapter Set

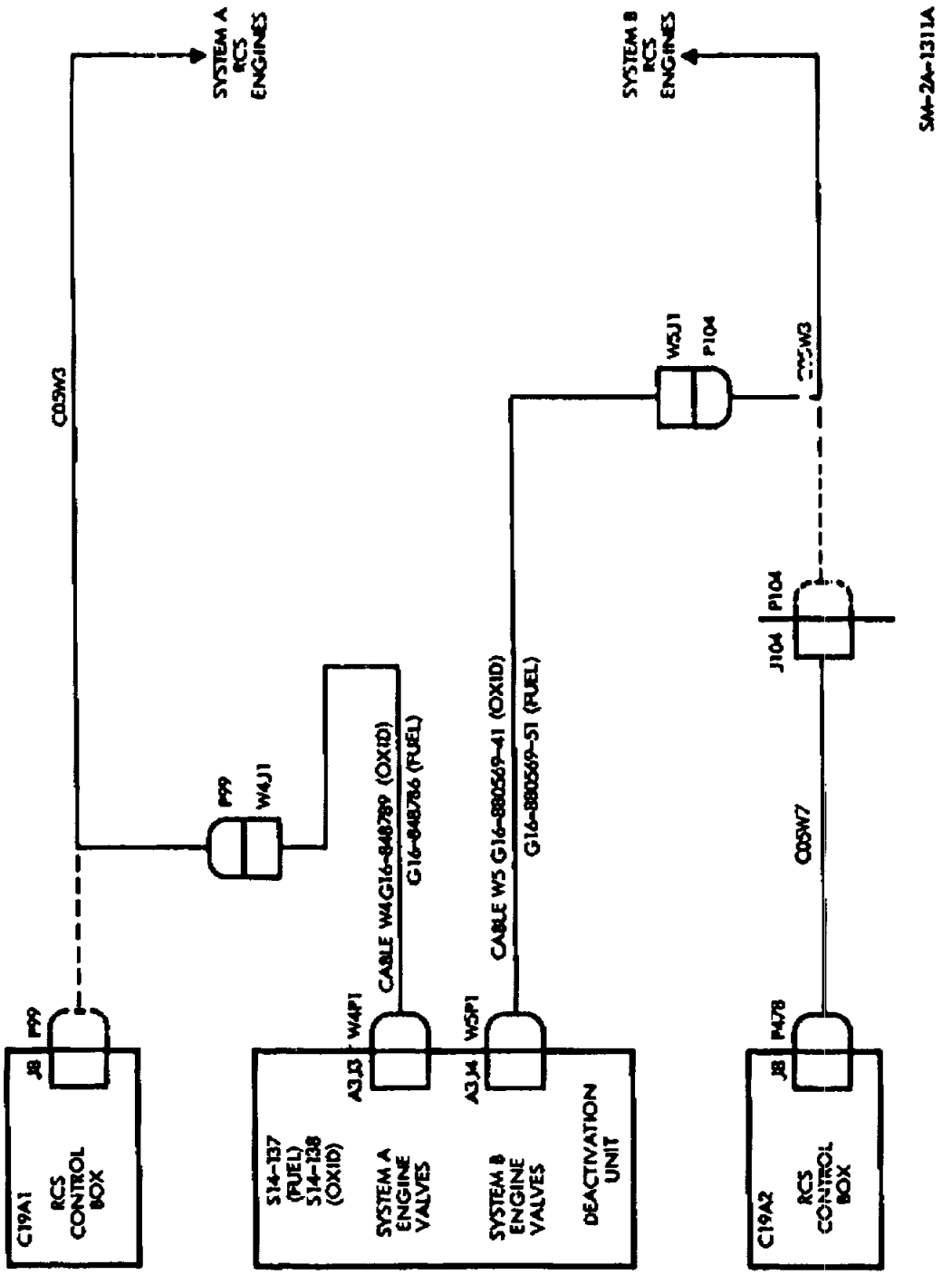
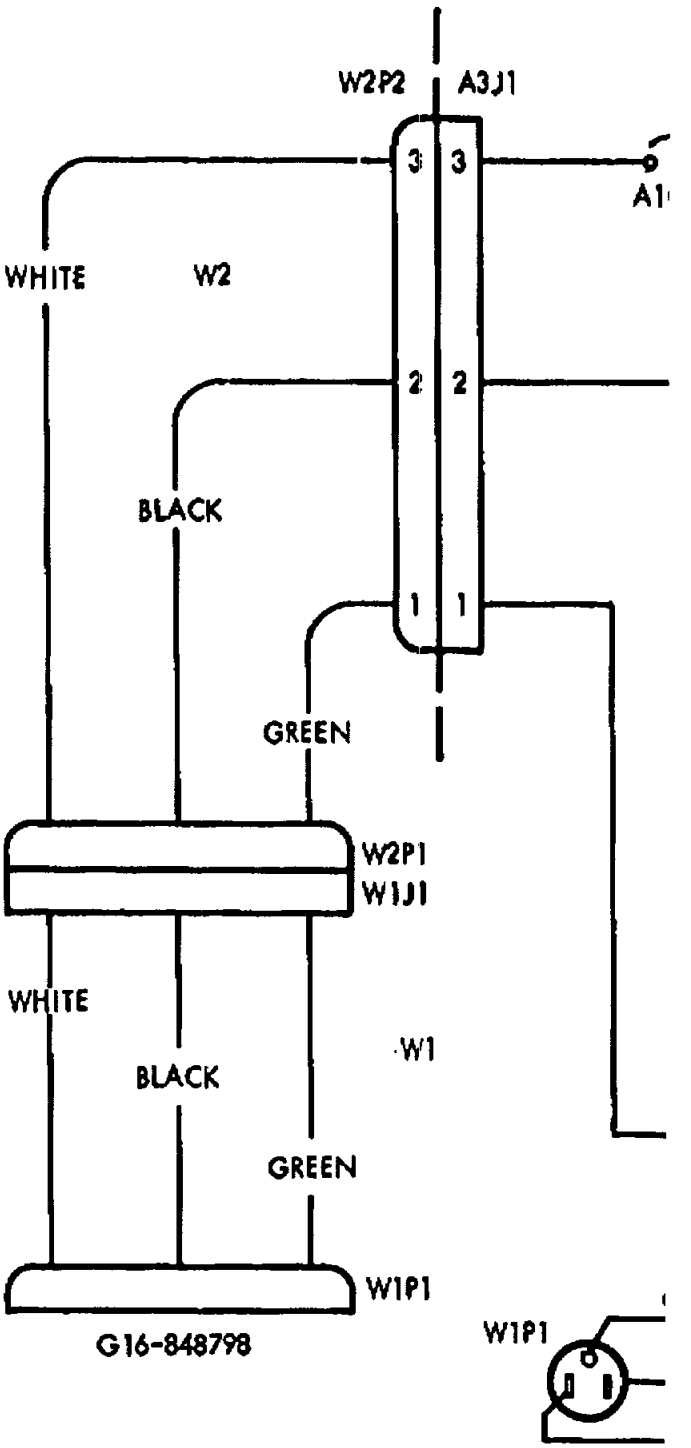
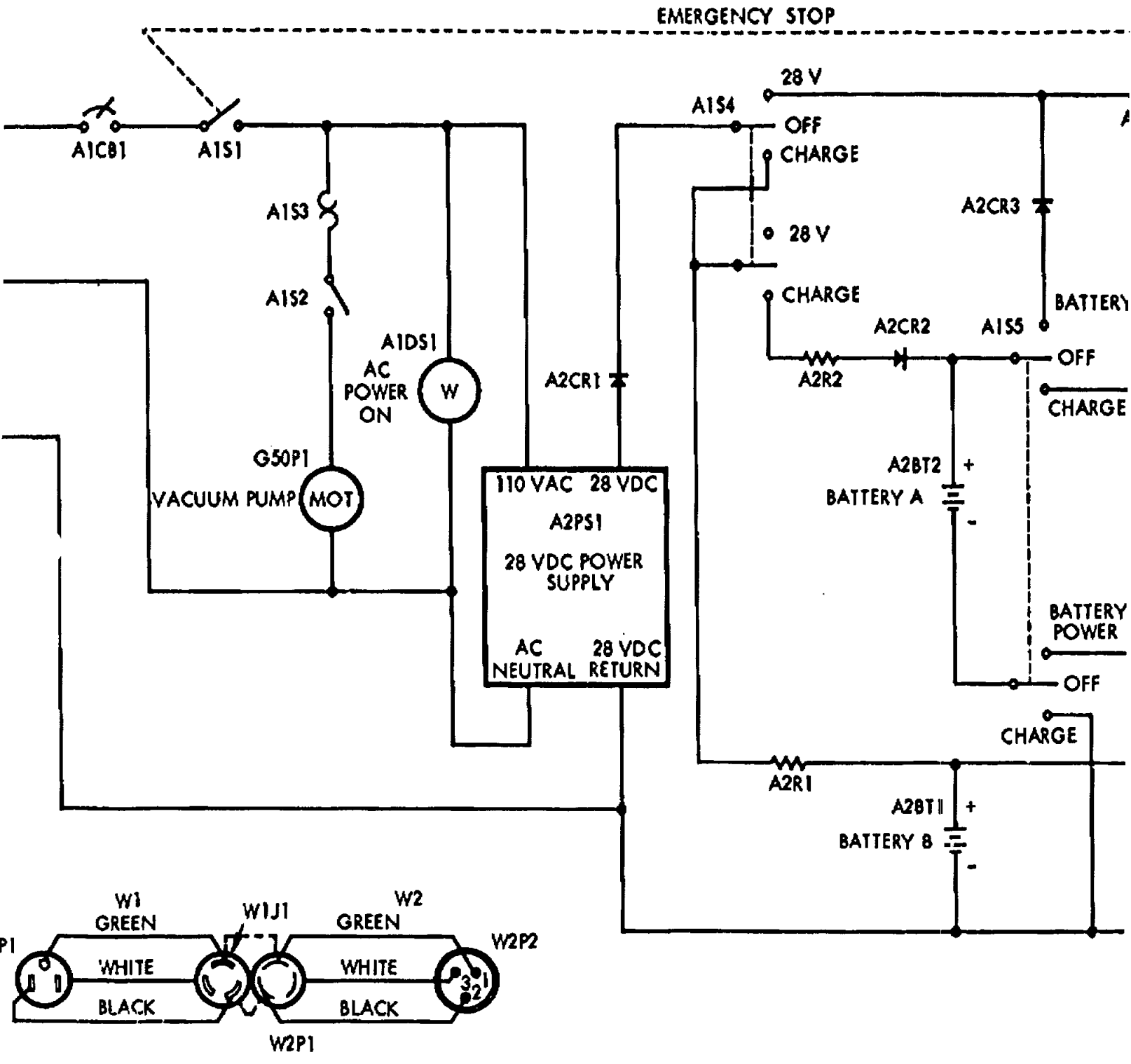


Figure 9-6. RCS Engine/Deactivation Unit Interface Hookup Block Diagram


W2P2
A3J1
3
3
A1
WHITE
W2
2
2
BLACK
1
1
GREEN
W2P1
W1J1
WHITE
W1
BLACK
GREEN
W1P1
G16-848798
W1P1


EMERGENCY STOP
28 V
A1S4
OFF
CHARGE
28 V
A1C81
A1S1
A1S3
A1S2
A1DS1
AC POWER ON
W
A2CR1
A2CR3
CHARGE
BATTERY
A2CR2
A1S5
A2R2
OFF
CHARGE
G50P1
VACUUM PUMP
MOT
110 VAC 28 VDC
A2PS1
28 VDC POWER SUPPLY
AC NEUTRAL
28 VDC RETURN
A2BT2
+
BATTERY A
-
BATTERY POWER
OFF
CHARGE
A2R1
A2BT1
+
BATTERY B
-
W1
GREEN
W1J1
W2
GREEN
W2P2
WHITE
WHITE
BLACK
BLACK
3
2
1
W2P1

Figur

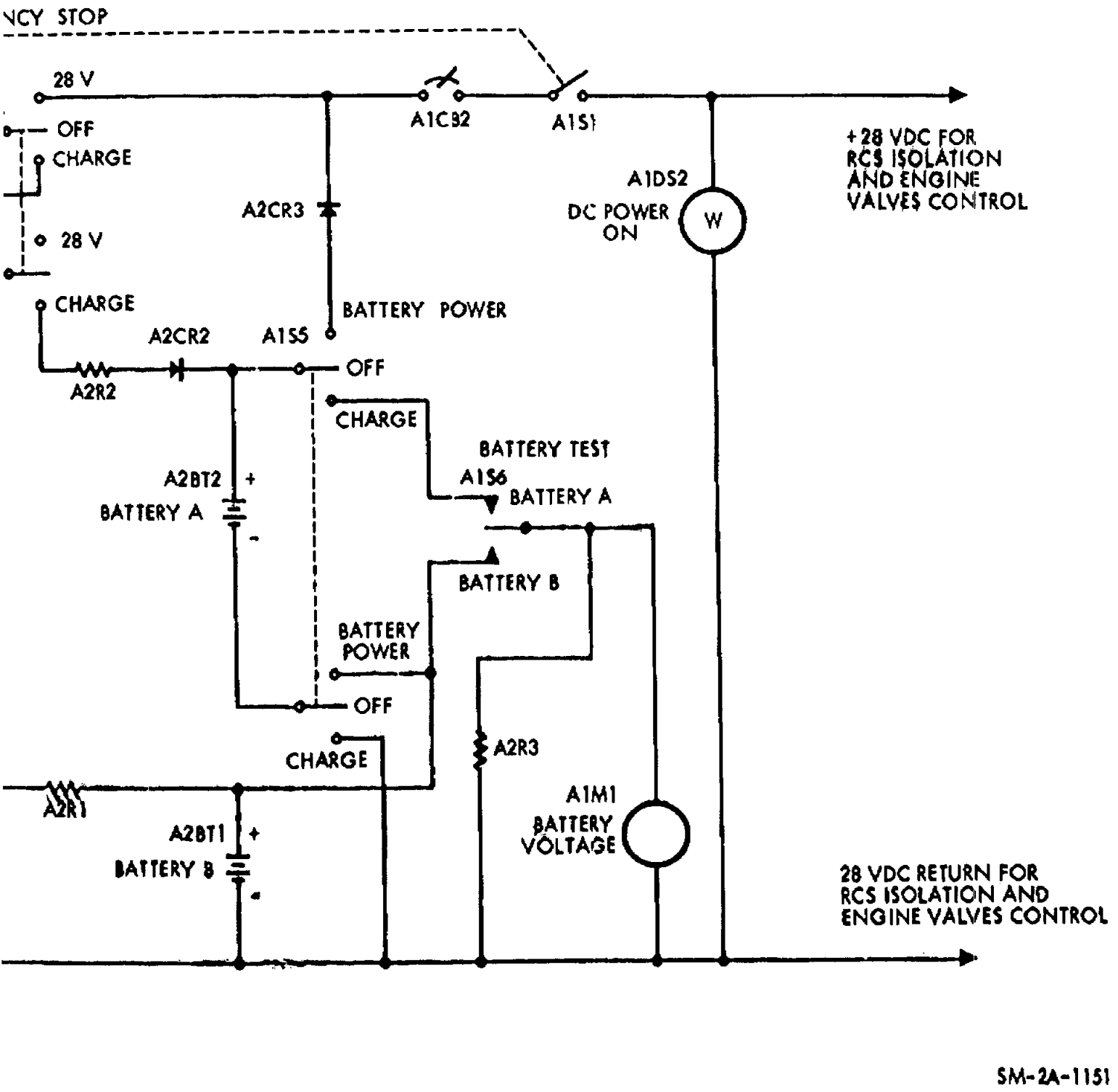
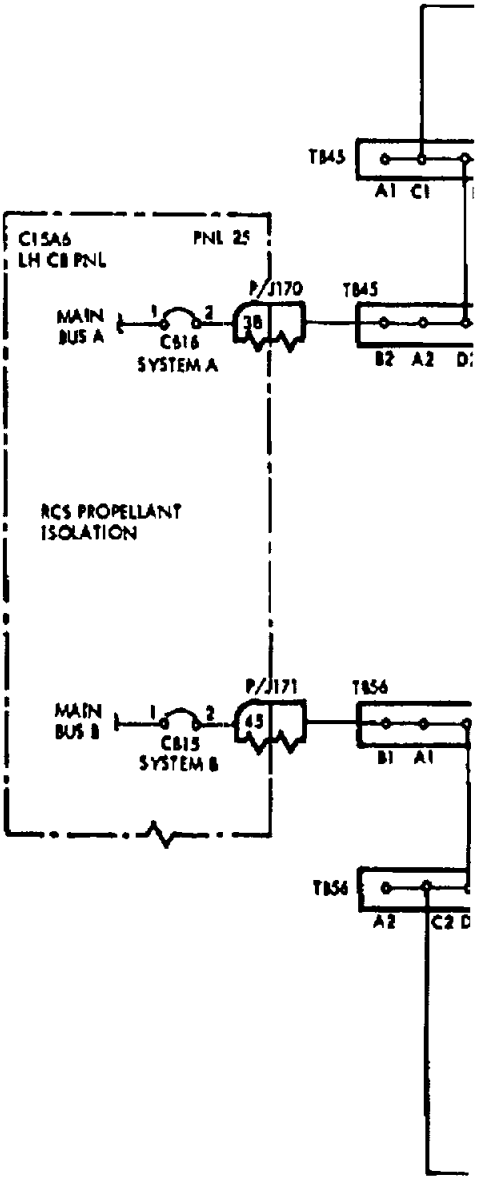
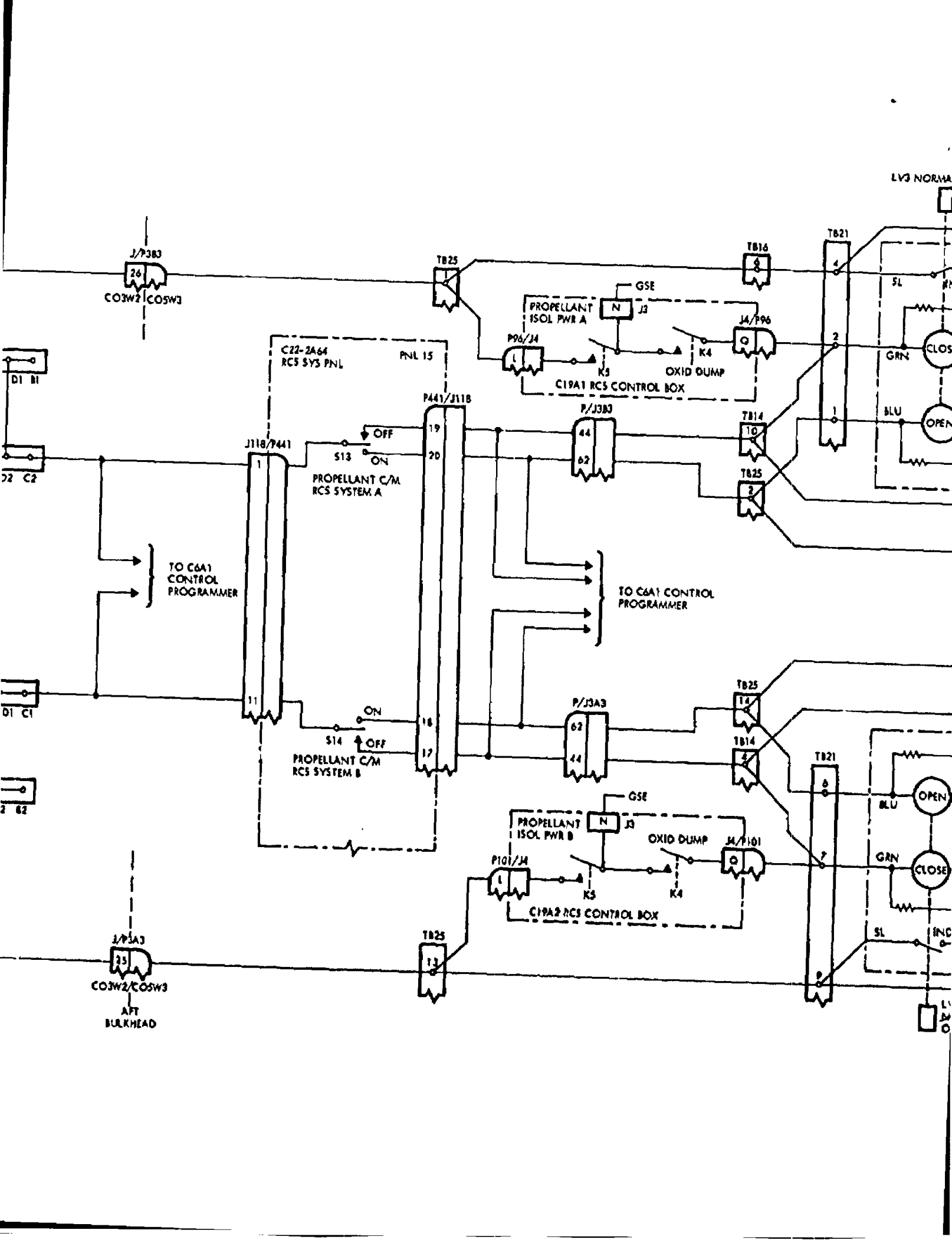


Figure 9-7. S14-137/S14-138 Facility Power Hookup


TB45
A1 C1
C15A6
LH CB PNL
PNL 25
P/J170
TB45
MAIN
BUS A
1
2
CB16
SYSTEM A
38
B2 A2
RCS PROPELLANT
ISOLATION
P/J171
TB56
MAIN
BUS B
1
2
CB15
SYSTEM B
43
B1 A1
TB56
A2 C2


J/P383
26
CO3W2/CO5W3
TB25
TB16
TB21
GSE
PROPELLANT ISOL PWR A
N
J3
J4/P96
P96/J4
K5
K4
OXID DUMP
C19A1 RCS CONTROL BOX
C22-2A64
RCS SYS PNL
PNL 15
P441/J11B
J11B/P441
OFF
S13
ON
PROPELLANT C/M RCS SYSTEM A
P/J3B3
TB14
TB25
TO C6A1 CONTROL PROGRAMMER
TO C6A1 CONTROL PROGRAMMER
ON
S14
OFF
PROPELLANT C/M RCS SYSTEM B
P/J3A3
GSE
PROPELLANT ISOL PWR B
OXID DUMP
J4/P101
P101/J4
C19A2 RCS CONTROL BOX
J/P3A3
CO3W2/CO5W3
AFT BULKHEAD
SL
GRN
BLU
OPEN
CLOSE

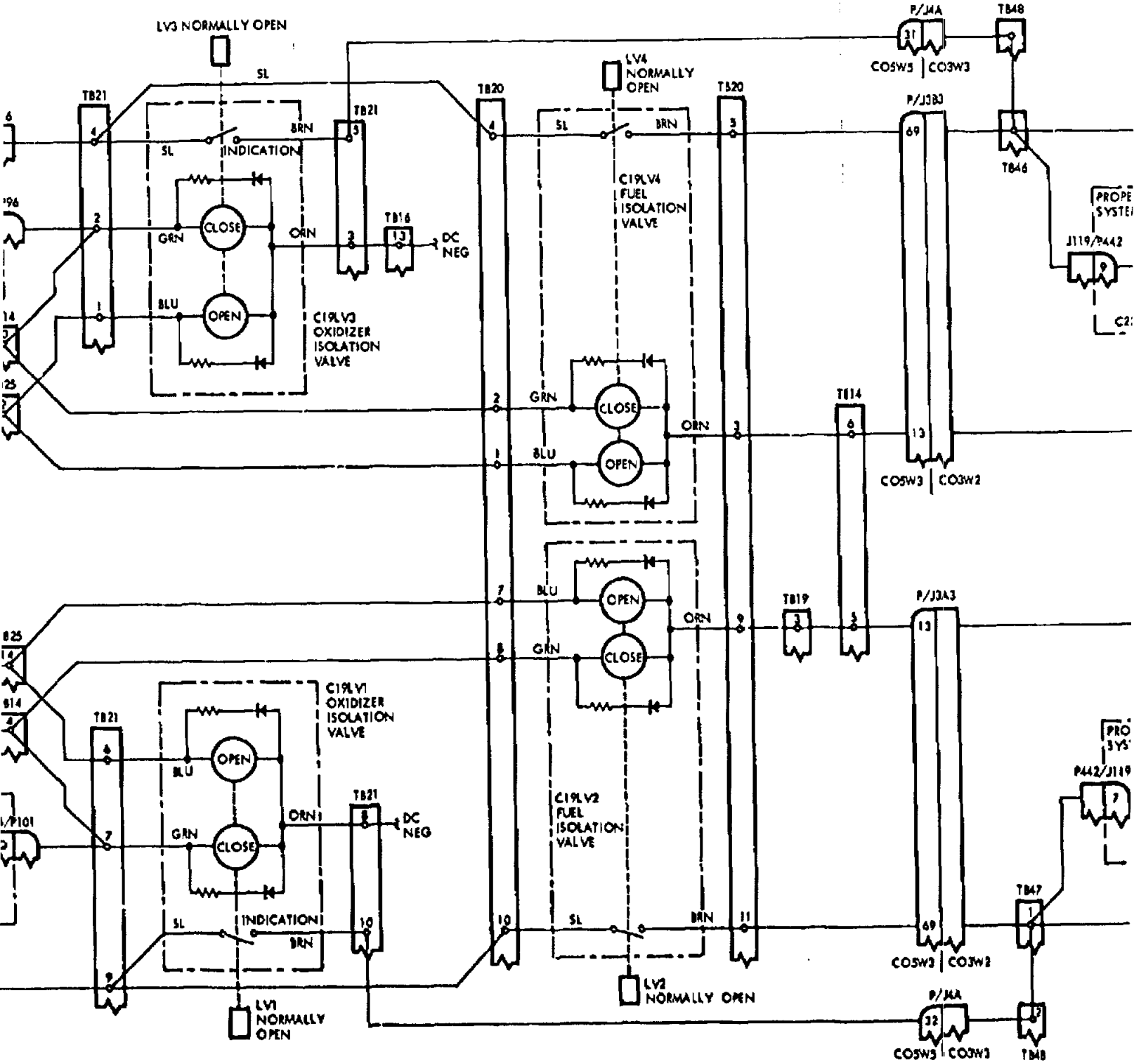


Figure 9-8. CM RCS Isolation Valves Cor

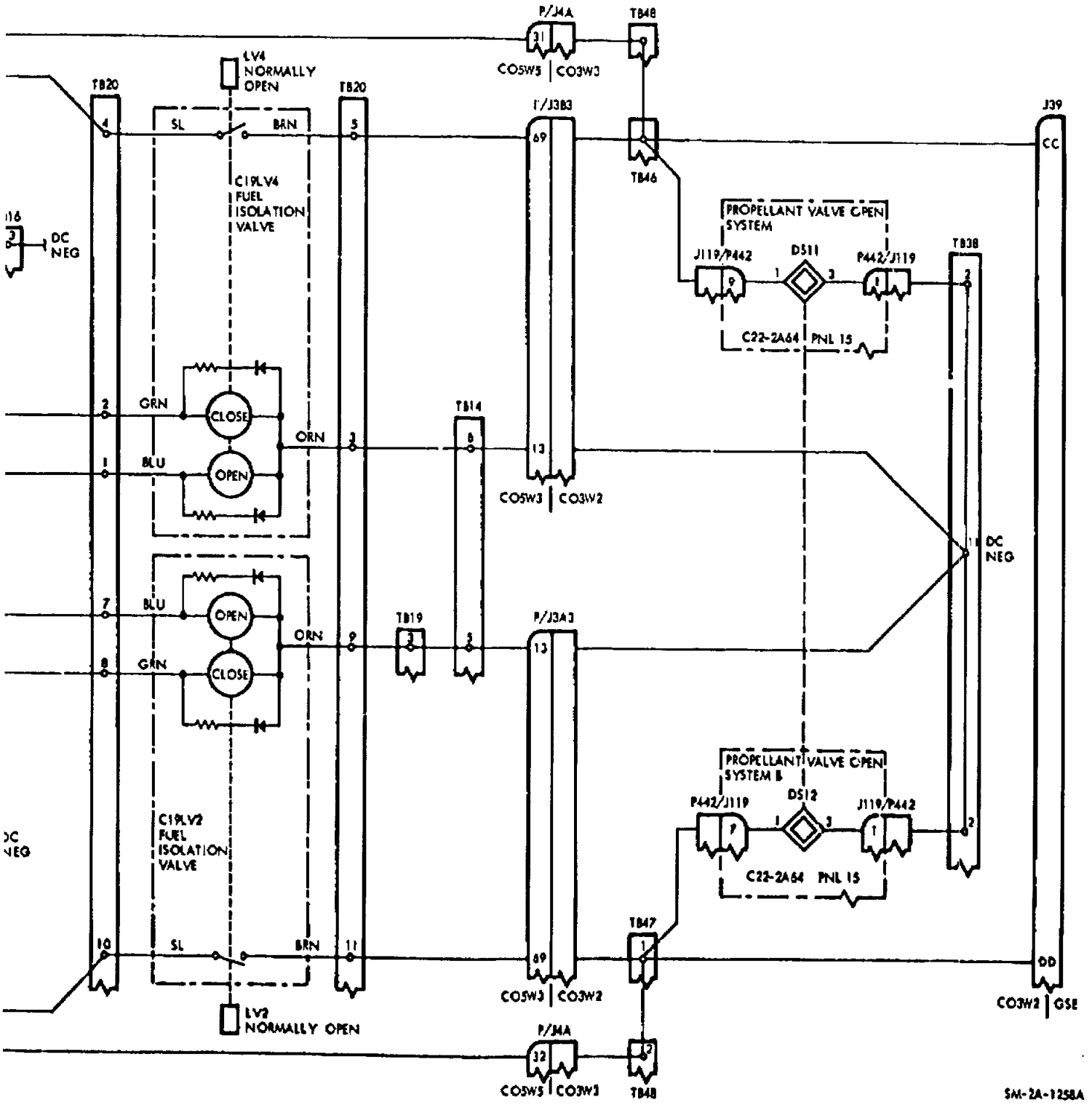


Figure 9-8. CM RCS Isolation Valves Control, Electrical Schematic

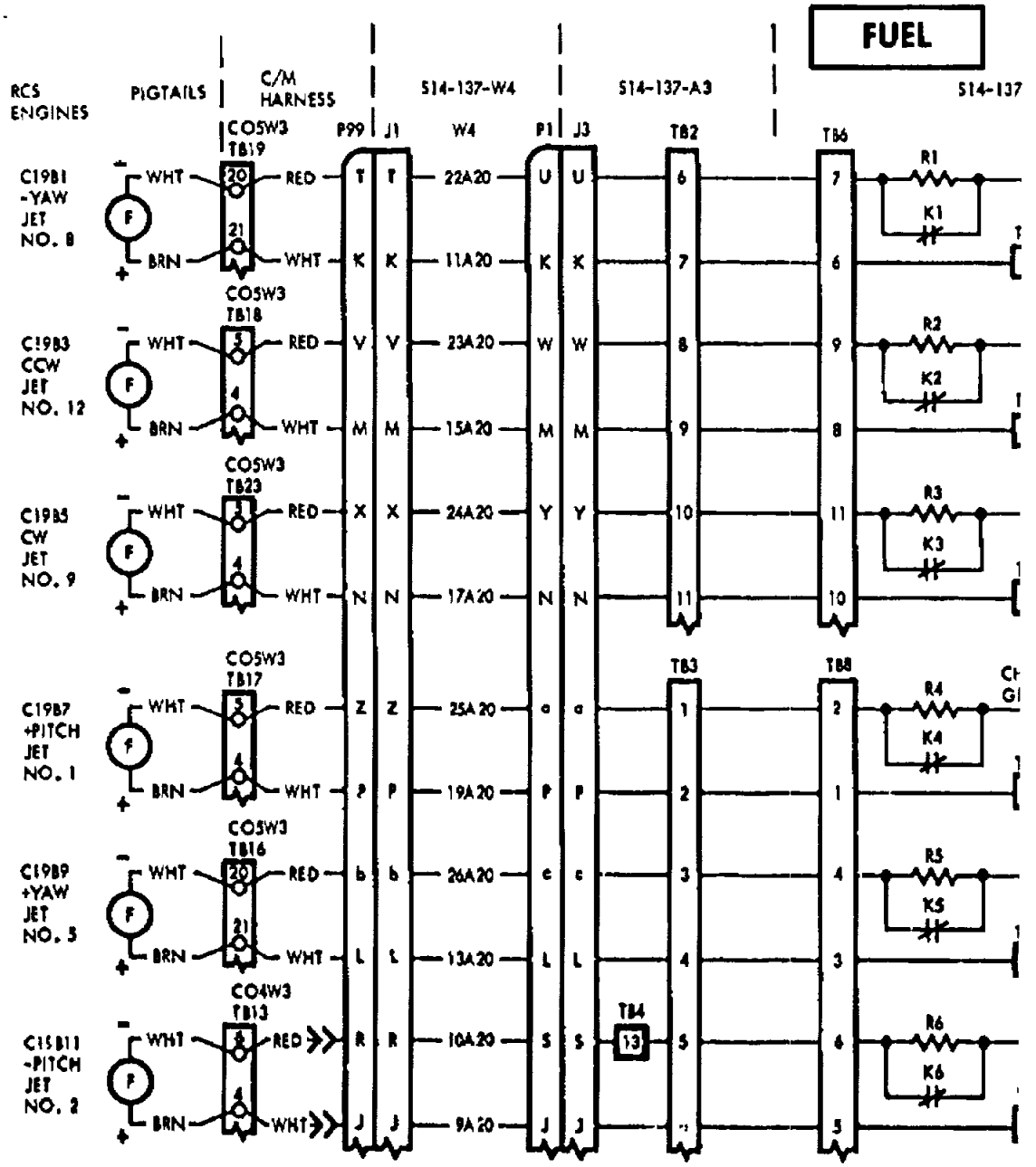

FUEL
RCS ENGINES
PIGTAILS
C/M HARNESS
S14-137-W4
S14-137-A3
S14-137
C1981 -YAW JET NO. 8
C1983 CCW JET NO. 12
C1985 CW JET NO. 9
C1987 +PITCH JET NO. 1
C1989 +YAW JET NO. 5
C1511 -PITCH JET NO. 2
WHT
RED
BRN
WHT
C05W3 TB19
C05W3 TB18
C05W3 TB23
C05W3 TB17
C05W3 TB16
C04W3 TB13
P99
J1
W4
P1
J3
TB2
TB6
TB3
TB8
TB4
R1
K1
R2
K2
R3
K3
R4
K4
R5
K5
R6
K6

Figure 9-

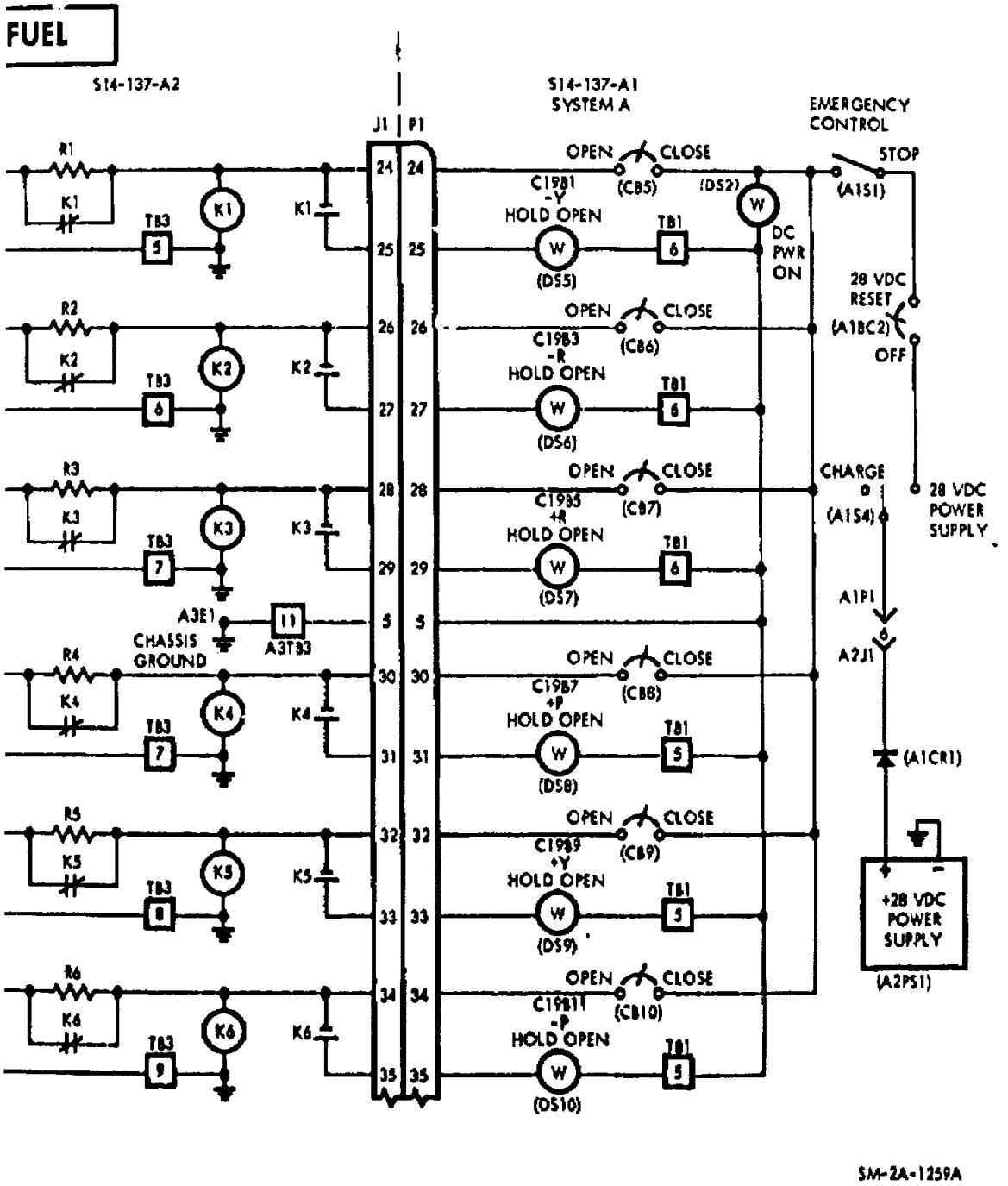


Figure 9-9. S14-137 — CM RCS System A Interface Schematic

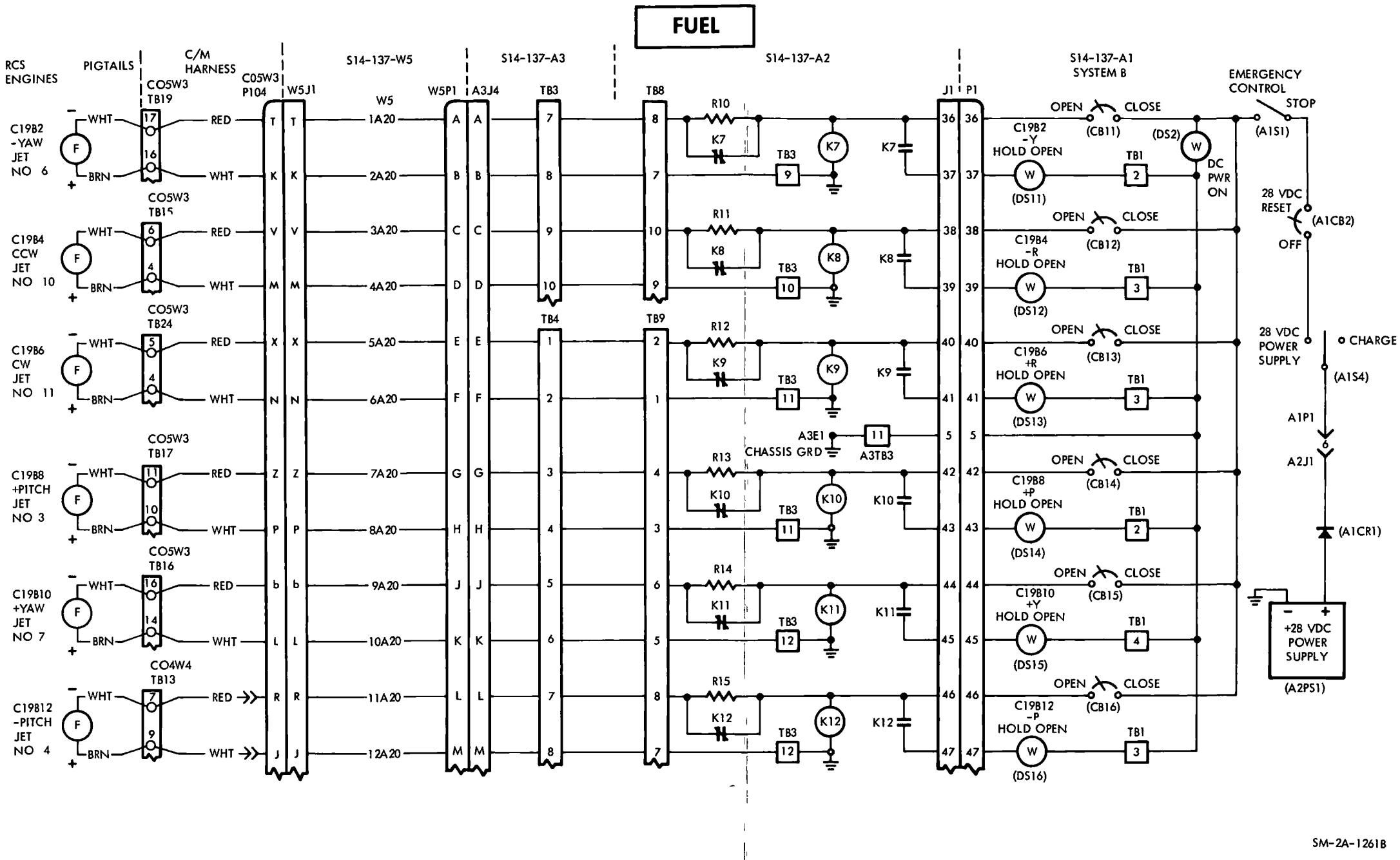


Figure 9-10 S14-137—CM RCS System B Interface Schematic

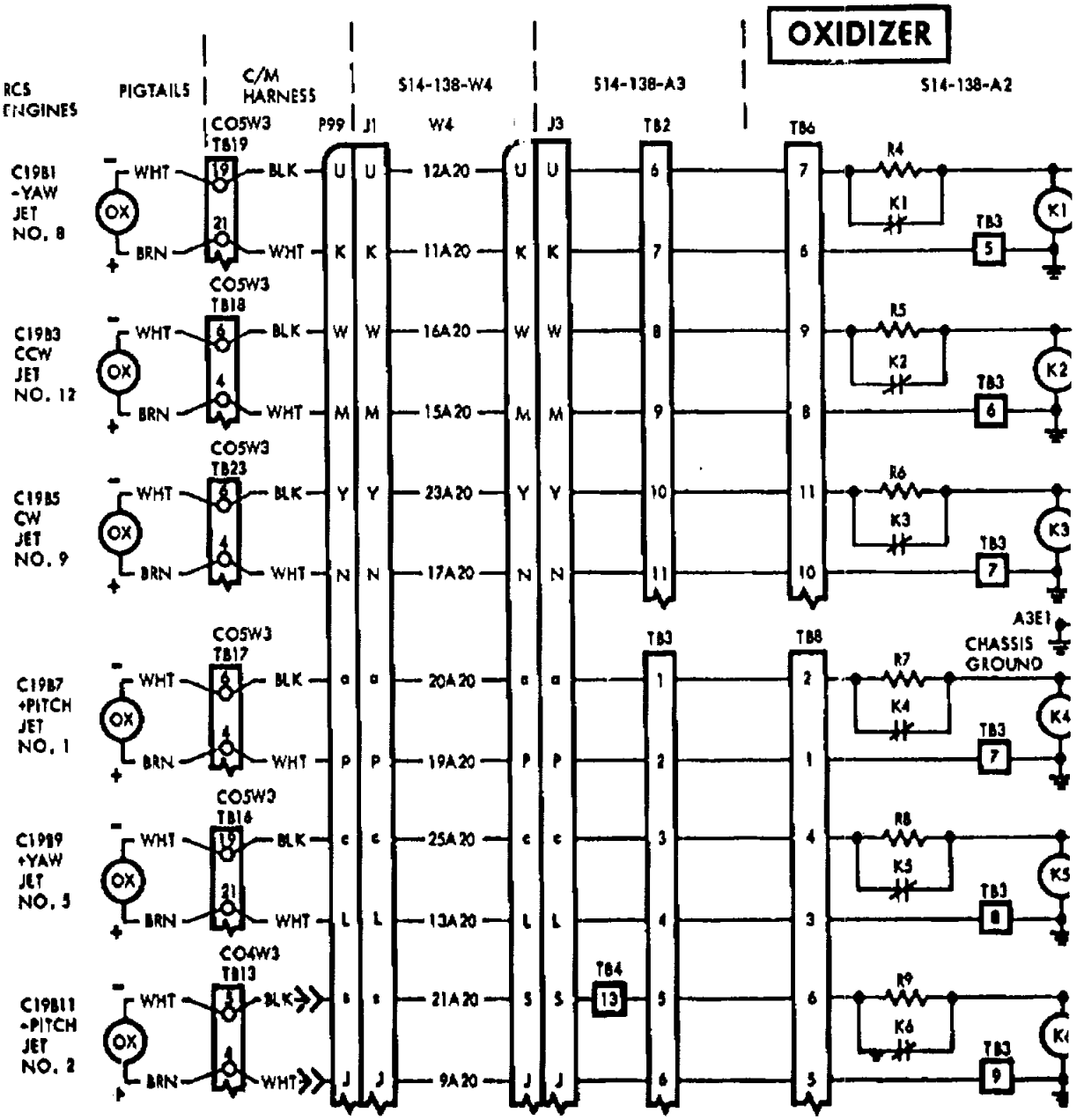

OXIDIZER
RCS ENGINES
PIGTAILS
C/M HARNESS
S14-138-W4
S14-138-A3
S14-138-A2
C19B1 -YAW JET NO. 8
C19B3 CCW JET NO. 12
C19B5 CW JET NO. 9
C19B7 +PITCH JET NO. 1
C19B9 +YAW JET NO. 5
C19B11 -PITCH JET NO. 2
WHT
BRN
BLK
OX
CO5W3 TB19
CO5W3 TB18
CO5W3 TB23
CO5W3 TB17
CO5W3 TB16
CO4W3 TB13
P99
J1
W4
J3
TB2
TB6
TB3
TB4
TB8
R4
R5
R6
R7
R8
R9
K1
K2
K3
K4
K5
K6
A3E1
CHASSIS GROUND

Figure 9-11. S

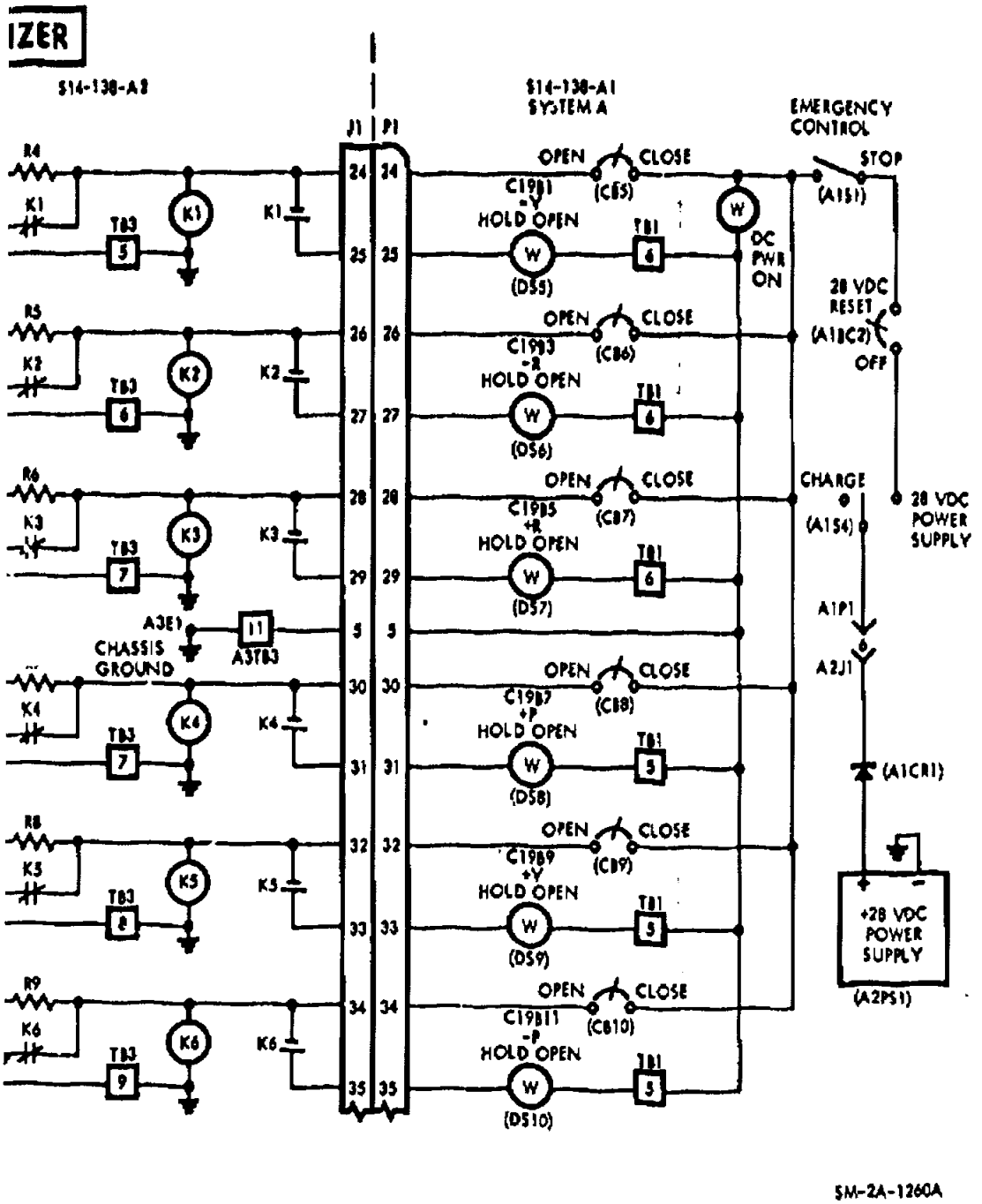


Figure 9-11. S14-138— CM RCS System A Interface Schematic

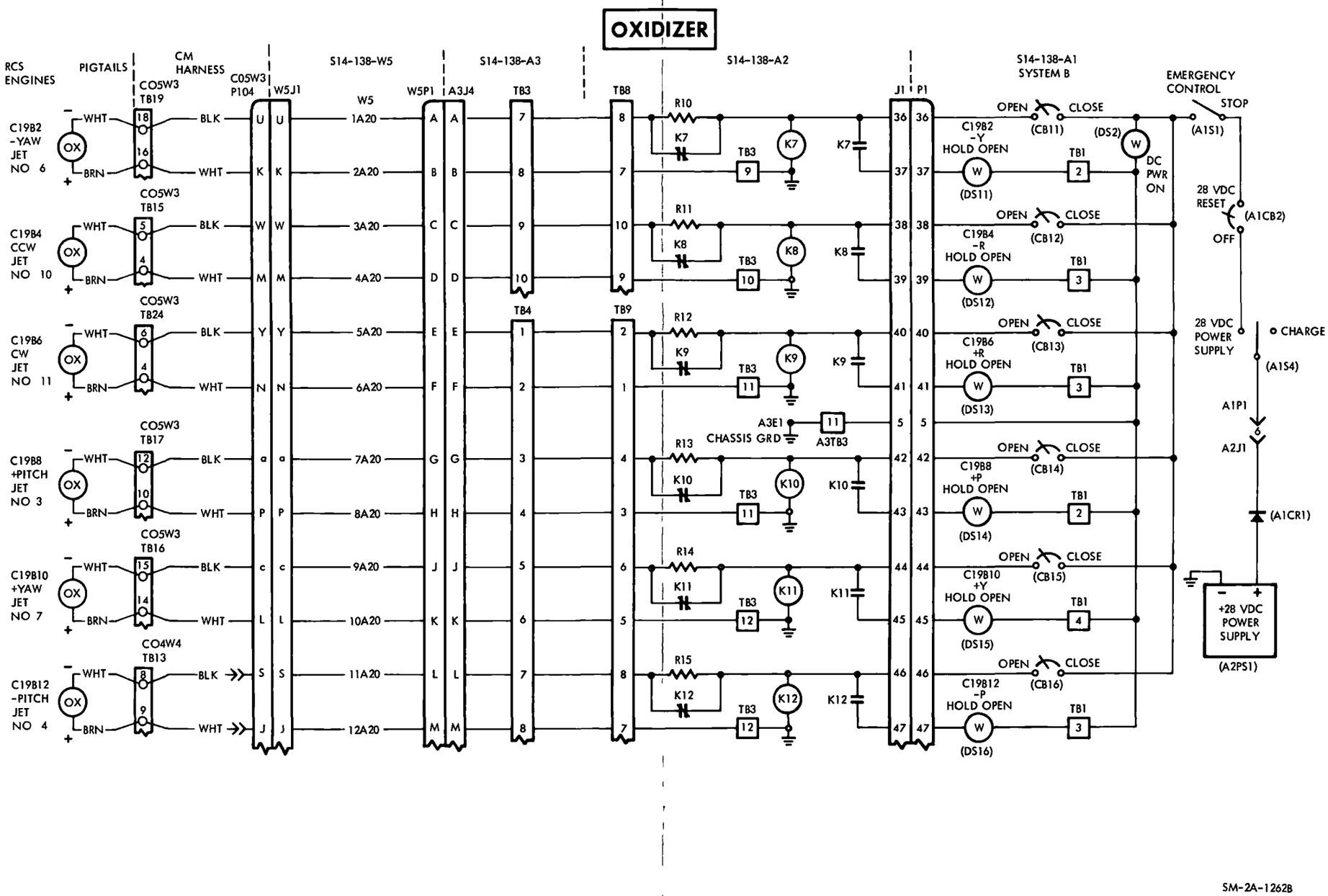


Figure 9-12 S14-138—CM RCS System B Interface Schematic

APPENDIX A

BIBLIOGRAPHY

A-1. GENERAL

A-2. The purpose of this appendix is to provide a listing of reference documents applicable to Apollo deactivation and safing operations. Accordingly, it is recommended that concerned personnel review the documents which may affect their particular assignment. The knowledge gained by reviewing the individual documents will prove invaluable when the need for information of this nature arises.

Number	Originating Agency	Title	Description of Contents
None	NASA-LRD MSC-Houston	Apollo Recovery Operations, Mission AS-501, SC017	Provides recovery data applicable to the DOD and LRT members.
SID 66-1892 SM2A-08-SC017	SD, NAA, Inc. Downey, Calif.	Apollo Postretrieval Procedures, Mission AS-501, SC017	Provides postretrieval procedures required aboard the recovery vessel.
None	NASA MSC-Houston	Operating Instructions for the Apollo Spacecraft Handling Dolly	Provides familiarization information and operating instructions.
AFM 127-101	Dept. of the Air Force	Accident Prevention Handbook	Provides information relative to the prevention of ground accidents.
T.O. 11A-1-40	Ordnance Corps, Dept. of the Army	Ordnance Safety Manual	Provides established Ordnance Corps safety rules and regulations.

Number	Originating Agency	Title	Description of Contents
T.O. 11A-1-40D	Dept. of the Air Force	Ordnance Safety Manual	Defines the applicability of the Ordnance Safety Manual (T.O. 11A-1-40 for Air Force use.
SP4-41-S	NASA-KSC Safety Office	Radiological Safety Handbook	Distinguishes between real and imagined dangers of radiation.
SP4-44-S	NASA-KSC Safety Office	Liquid Propellants Safety Handbook	Provides information designed to familiarize personnel with liquid propellant safety requirements.
SP4-43-S	NASA-KSC Safety Office	Explosive Safety Handbook	Sets forth precautions and procedures applicable to personnel handling explosive devices.
None	Test Evaluation Branch, Mission Operations Division, MSC-Houston	Postflight Test Requirement, Mission AS-501, S/C017	Provides detailed postflight testing requirements by system/subsystem.
MA0210-0162	SD, NAA, Inc. Downey, Calif.	RCS Propellant Post Landing Decontamination Procedure-Apollo C/M.	Provides engineering data relative to propellant decontamination of the CM-RCS.

Number	Originating Agency	Title	Description of Contents
MA0117-001	SD, NAA, Inc. Downey, Calif.	Handling of Flammable and Dangerous Liquids and Chemicals	Describes in general terms, hazards associated with varying materials used by NAA. (Deactivation personnel should be familiar with portions pertaining to solvents and compressed gases.)
994840	Mine Safety Appliances Co.	M-S-A Portable Billion-Aire Analyzer	Provides information relative to operation and field servicing of the Billion-Aire vapor detector.
AFM 127-201	Dept. of the Air Force	Missile Safety Handbook	Provides general information relative to hazards involved in operating missile systems, and describes measures for preventing mishaps.
None	USAEC (1965)	Handbook of Federal Regulations Applying to Transportation of Radioactive Materials	Provides rules and regulations pertaining to the transportation of radioactive material.
AII-K5	SD, NAA, Inc. Downey, Calif.	Apollo Program Implementing Instruction Sub: Support Manual Changes.	Instruction establishes the system for requesting changes to support manuals. NOTE Personnel desirous of suggesting changes to this manual should utilize Form 954-D-2. (See following page.)